THE AMERICAN GAS LIGHT JOURNAL

PUBLISHED WEEKLY, AT NO. 42 PINE STREET.

VOLUME XCVI., No. 26.
Whole No. 1,933.

NEW YORK, MONDAY, JUNE 24, 1912.

Subscription, $3 Per Year.
$4 Canada, $5 Foreign.

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The Use of Gas for Heat and Power: the Testing of Gas.

[Lecture Delivered by MR. E. B. ROSA, Chief Physicist, Bureau of Standards, Depart. Commerce and Labor, Washington, D. C., at Centenary Celebration of Gas as an Illuminant, Franklin Institute, Philadelphia, Pa.]

The use of gas for heat and power has rapidly increased in recent years, partly due to a reduction in the price of gas and to improvement in the service rendered by gas companies, and partly to the improvement of gas appliances in the direction of greater convenience and efficiency, and to the invention of new appliances for the accomplishment of many results in new ways. With more than 1,300 gas companies in the country, with a combined capital of $1,000,000,000 and annual sales of $200,000,000, it is one of the most important of the industries.

1. USE OF GAS FOR HEAT AND POWER.

Coal Gas.—The first recorded suggestion of the use of gas for fuel was in the patent (taken out in England in 1805), by F. A. Winsor, for a process of "extracting inflammable air" from coal. The product was to be applied to heating as well as to lighting; but, in spite of his great enthusiasm, Winsor was not successful in bringing about the utilization of gas for fuel, and little was done along this line until about 1825, when the first gas cooker was invented. From that time until about 1880 development was very slow.

One important invention, however, was that of Delbruck, who placed one tube inside another, using one for the gas and the other for the passage of the air, using the two at the point of ignition.

What are usually called Bunsen burners, in connection with gas stoves, are a modification of Bunsen burners, invented by Thomas Fletcher, of England. The true Bunsen consists simply of the familiar open tube of the laboratory, with the gas nozzle and air ports at the base. Fletcher was the first to use a cap to diffuse the flame and reduce its liability to flash back.

The last 30 years have witnessed a wonderful development of every kind of heating appliance, and the most modern gas lighting units making use of the gas for heating solid materials to incandescence instead of deriving the light from the luminosity of the flame itself.

Acetylene Gas—Although acetylene gas was discovered in 1836, it was not until 1892 that its commercial development was made possible, by Willson, who discovered a method of producing calcium carbide in large quantities. The application of acetylene to heating and power has been very recent indeed, and the use of acetylene and oxygen in the blow pipe has produced almost the highest temperature known to chemistry—a temperature approximating that of the electric arc, probably above 5,000° F. Through this means welding has been successfully accomplished and several other important industrial applications have been found. Large steel bridge girders can thus be cut apart with ease. There seems to be a great field open for the oxy-acetylene flame.

Natural Gas.—The first use of natural gas in this country was probably in Fredonia, N. Y. (1821), and before long it was being used in rare instances for heating purposes. In 1859, Drake drilled the first oil well, and, as natural gas was found in abundance, its use was greatly increased. At first it was only used near the wells, but from time-to-time some enterprising individuals would run pipes from nearby wells to their homes and villages. At first it was used in the coal or wood stoves for cooking and heating, and at the wells for power, by piping it directly to the cylinders of steam engines and using its expansive force as a substitute for steam. The waste of gas for many years was very great, no interest being taken in making economical appliances, or even in turning the gas off when not wanted. The first company formed exclusively for the distribution of natural gas was in 1872, in Titusville, Pa., since which time its use has become quite extended.

As a fuel, natural gas is burned in almost exactly the same way, and with almost the same appliances, as manufactured gas. It may be used in the ordinary gas range, hot plate, water heater, or other gas burning appliances, the only change necessary being that, because of the higher pressure, the gas orifices should be smaller, and because of the higher heating value less gas is necessary to produce the same results. Furthermore the application of natural gas to coal burning installations of all kinds is very simple and, as a rule, very efficient.

The growth of the business in the last 30 years is shown by these figures from the United States Geological Survey, representing the approximate value of natural gas produced in the United States:

Year.	Value.
1882	$ 215,000
1892	14,870,714
1902	30,867,863
1909	63,206,941

Producer Gas—Producer gas, a gas made from cheap fuels, using

oxygen from the air to produce carbon monoxide, has come into prominence within the last 12 years. Although only a few scattered installations are reported as having been made in the United States prior to 1900, there are now probably 200 or more plants together having an output of over 50,000 horse power.

The two principal types of gas producers are the suction plant, used for small units below 300 horse power capacity, and the pressure plant used for larger outputs. The suction plant receives its name from the fact that the engine develops its charge of gas in the producer by means of its own suction stroke. The pressure plant develops its gas under a slight pressure due to the introduction of an air and steam blast, and the gas is stored in a holder until it is required by the engine.

In Europe producer gas has been applied much more generally than in this country, but it is fast working its way into the industries here, such as glass furnaces, brick, pottery and terra cotta kilns, lime and cement kilns, sugar house char-kilns, silver chlorination and ore roasting furnaces, etc. Although its use is accompanied by some dangers and disadvantages, the fact that it is the cheapest gas made per unit of heat and contains more of the energy originally in the coal than any other, and that it is possible to use very pure fuel in its production, make it a very economical gas when properly applied.

Conditions for Good Combustion.—One of the principal points to consider in the construction of heating appliances is the combustion of the gas. Efficiency, maintenance and many other important items are largely dependent on this feature. Some of the conditions for good combustion are:

(a.) Complete and equal combustion of the gas must be had over every part of the burner and from every opening in the burner.

(b.) Good mixing of air and gas, and equal proportion of primary air in all parts of the burner are essential.

(c.) There must be plenty of secondary air in the proximity of the burners, so that the flames will not be smothered, and good draft through the appliance to carry away the products of combustion.

(d.) Flames should not impinge on cold surfaces in such a way as to cause incomplete combustion, and so waste the heat and perhaps produce carbon monoxide.

(e.) In those appliances where an adjustable air shutter is used, this shutter should be easily adjustable, and yet should remain as adjusted. In those appliances that have a fixed air supply, the spuds should be readily accessible. Each different form of apppliance offers problems of its own, but the observance of these general conditions is important.

Development of Gas Cooking.—In the patent taken out by Mr. Winsor, in 1805, for the manufacture of coal gas, we find the first recorded suggestion of the use of gas for cooking; but the actual utilization of gas for cooking was much later. Our earliest knowledge of a gas stove is to be obtained from a magazine, of the year 1825, which described it as a piece of "Gas apparatus for cooking by inclosing the circle of gas flames with its reflecting cone in a cylinder of tin, from the top of which a pipe takes off the burnt air." A drawing of the burner was also given and the writer adds: "A hot plate has been heated by the gas, and it has also been employed to heat an oven. * * * It cannot be expected to succeed, however, except in the hands of persons whose scientific knowledge enables them to employ it with safety."

For a number of years there seems to have been little done in the way of actual trial, although the geniuses of the time were thinking about it and taking out patents. It is unlikely that we shall ever know who was the first user of gas for cooking; all we know definitely about the subject being that James Sharp, of Northampton, England, demonstrated the availability of gas cooking in his own house, about 1830 or 1832, and a year or two later John Barlow, of Islington, London, had an apparatus for roasting, boiling and steaming in the kitchen of his house. This consisted of a tin oven, around the four sides of which, inside, near the bottom, ran a gas pipe, fitted with small burners about an inch apart; on a stand alongside the oven were 2 or 3 rings of piping with burners, and over these were placed the boilers and saucepans. After this, inventions for cooking by gas became more numerous, although the gas range at first gained very slowly in popularity.

In 1850 James Sharp, then of Southampton, delivered a lecture entled "Gastronomy," in the course of which he roasted before the audience 34 pounds of beef, 15 pounds of mutton, and 12 pounds of pork, and boiled and steamed 24 pounds of mutton and codfish, 4 fowls, 8 plum puddings, vegetables, etc., and baked pies and tarts, the whole being done with the expenditure of 156 feet of gas.

In the following year (1851) Alexander Graham, a well-known hotel proprietor of Glasgow, exhibited, in the Great Exposition in London, a gas cooking oven, which was fitted with luminous jets inside. Mr. Graham made and sold a limited number of cookers for hotels and restaurants, but so far the use of ovens for domestic purposes was practically unknown.

A stove used in Philadelphia, prior to 1860, is still in existence and forms part of the exhibition in connection with this Centennary. It has a peculiar boiling burner which consists of a piece of ½ inch pipe, bent upwards into a sheet iron truncated cone, containing a perforated baffleplate of the same material. The upper end of the cone contained a fine wire screen covered with about ½-inch of fine gravel.

From this time on, until about 1880, the history of the use of gas for cooking was an exceedingly slow development. In 1860, the Cincinnati *Gazette* said: "At the present about 100 families are cooking with different kinds of gas stoves."

The development has taken a faster pace in recent years and thus has brought us to the present state of efficiency and convenience. The gas cooking range of to-day is distinguished by the following features: The flow of the hot products of combustion from the oven burners is so directed that the food is evenly cooked top and bottom in any part of the oven; air space insulation of the oven walls prevents the loss by radiation of an undue quantity of heat; adjustable air mixers on all burners permit of the complete elimination of soot; the boiling burners are so set that the placing of vessels over them does not smother the flames, nor cause incomplete combustion; the boiling burners and their fixtures are easily removed by the cook for purposes of cleaning, are put in place again with equal ease, and all details are aimed to combine efficiency and convenience.

Tests of the relative heat efficiency of gas ranges have been made, but such tests have not been sufficiently standardized so that numerical statements can easily be made. Further tests are desirable, and if greater attention is given to the question of efficiency and economy, it is probable that considerable further improvement will be made by manufacturers.

Gas Water Heating—About 1825 Robert Hicks took out a patent in England for "Heating water in baths by means of burning spirits of turpentine, or carbonetted hydrogen gas in chambers, in the bath, or in tubes passing through or under them."

Up to about 1890 there were really no convenient and economical water heaters. Since then the instantaneous hot water heater has been developed, and this has greatly augmented the use of gas ranges, the one being a very important adjunct to the other. Gas water heating is one of the most important of the domestic uses of gas, and it is very desirable that water heaters be tested systematically and the results of tests made public for the information of users.

Gas Room Heating.—About the year 1833 a patent was granted to one Richard Barnes, for heating buildings by the combustion of gas or oil, applying the flame either externally to tubes or chambers through which currents of air were passing, or else placing the flame inside the tubes or chambers.

Peckston in his "Practical Treatise on the Manufacture of Gas," published in 1841, says: "Coal gas has of late years been applied to the heating of churches, chapels, shops, counting houses, etc., * * * and has been found to answer the purpose intended." The stove described closely resembled the cooking stove of 1825, except that it was provided at the top with a register instead of the flue.

A form of stove now very popular in England under the name of the "Gas-fire," consisting of lumps of incombustible material heated to a greater or less degree of incandescence by gas burners so as to resemble a coal fire, was patented by Edwards, in 1849. Seven years later Nathan Defries was granted a patent for a similar device, the "argillaceous material" specified having fastened upon it fibers of asbestos, which, upon lighting the gas, became incandescent. This was followed 3 years later by a patent granted to Reece for a stove in which the asbestos back was the main feature.

In spite of the limited use of gas for fuel a company called "The Gas Fire Company" was incorporated in England in 1852. This seems to be the forerunner of the many ill-fated attempts to do a purely fuel business by artificial gas. Room heating is now one of the common uses of illuminating gas.

The Use of Gas for Industrial Purposes.—In 1806 Mr. Josiah Pemberton exhibited various forms of gas lights in front of his factory at Birmingham. He was the first to construct a gas stove, using it for the soldering required in his button factory.

About 1840, a Scotch manufacturer by the name of Mackintosh made several tons of "cemented" steel by submitting iron at a dull red heat to the action of lighting gas. The carbon for the steel was derived from the gas.

In 1857 a patent was granted for the heating of irons for laundry work by means of gas, and in 1859 a soldering apparatus for continuous soldering by means of gas was described in the *Technical Press*. This included the use of a blast worked by a foot bellows.

In an advertisement of Elsner, of Berlin, (July, 1859), it was pointed out that there was scarcely a brand of domestic work, of industry, or of business for which a gas cooking or heating apparatus could not be recommended. Thus it is evident that the use of gas for industrial purposes is not of recent origin, and that it has not been brought about through a falling off in the use of gas for lighting, due to the increased use of electricity.

At the Paris Exposition (1867) there was exhibited singeing apparatus for use in wool works, dye works and bleaching works. Jewelers were also using gas. Plants for chemical and metallurgical purposes and laboratory ovens were also shown.

About 30 years ago what seems a curious method of using gas was considerably in favor. This was its use under boilers for generation of steam for engines up to about 2-horse-power. At the Royal Agricultural Societies Exhibition, held in 1879, several forms of such boilers were exhibited.

In 1879 the South Shields Gas Company, an English concern, gave an exhibition of over 300 appliances in which gas was to be used for other purposes than lighting.

To-day there are about 1,000 practical applications of gas in the industries, and a conservative estimate places the proportion of gas sold for fuel at one-half the total sales.

Air under Pressure vs. Gas under Pressure in Industrial Appliances.—The subject of air and gas under pressure is one that is receiving considerable attention at the present time, although the field has not been as extensively explored as the others that have been described.

In England and on the Continent there are a number of companies now operating to furnish gas at high pressure for private establishments as well as for the public street lamps. The result is that in Europe there has been more done with the gas under pressure than in America, while, on the other hand, America has probably made more use of the air blast with low-pressure gas: "The disadvantage of the latter for furnace heating is that the efficiency depends upon the two pressures remaining constant. Experience shows that, under working conditions, it is too much to expect that these will remain constant, but the main defect in air-blast burners up to quite recently has been that they were badly designed—their mixing arrangements being inadequate. Such gas burners as those recently designed which do away with secondary air and improve the mixing of the air and gas are a great advance on previous designs.

"High-pressure gas should have a great field before it in the industrial world. It can be applied to all heating processes with efficiencies reaching in some cases at least 90 per cent. Its chief charm is its cleanliness and its simplicity; and in by far the majority of cases it compares well in cost with solid fuel."

List of the Processes in Which Industrial Appliances are Used.—Some of the processes in which gas has been used in the industries are as follows:

(1) Hardening, tempering, and annealing of steel, and the heating of automatic heating machines.
(2) Melting of base and precious metals.
(3) Forging and drop forging.
(4) Welding, brazing, soldering, and rivet heating.
(5) Developing power and generating steam.
(6) Boiling liquids and melting of solids.
(7) Tire heating, and the heating of mangles and steel rolls.
(8) Heating japanning and embroidery ovens.
(9) Air tempering.
(10) Singeing of cloth.
(11) Heating branding irons.
(12) Firing china.
(13) Melting barium chloride and cyanide of potassium for hardening steels.
(14) Embossing and stamping presses.
(15) Heating muffle furnaces, and assay work, and reducing sweeps.
(16) Heating oil tempering furnaces.
(17) Pressing irons, stoves, and machines.
(18) Heating searing irons.
(19) Matrix drying in printing.
(20) Roasting coffee and nuts, and popping corn.
(21) Sterilizing and pasteurizing.

These are only a few of the many processes that might be mentioned, but they are typical as showing the wide variety of applications of illuminating gas.

Development of the Gas Engine.—The gas engine really dates from the year 1791, when John Barber patented an engine driven by gas obtained by heating wood, coal, oil, or other substance in a retort. After the gases had been cooled they passed through a pump, in which they were mixed with air, to an "exploder." At the orifice of this exploder the gas was lighted and issued, in a continuous stream of flame, against the vanes of a paddle wheel. This was not only the first gas engine but was the first gas turbine.

In 1794 Robert Street designed a pump driven by the explosion of turpentine vapor below the motor piston. In 1801 Phillippe Lebon took out a patent for an engine to give alternate explosions on each side of the piston. Samuel Brown, in 1823, designed a motor to operate by atmospheric pressure in which he used an explosive gas flame to expel the air from the chamber.

In 1823, L. W. Wright patented his double-acting, vertical engine combined with a governor to regulate the speed. In 1838 William Barnet suggested the compression system of gas motor. This experimental period of gas engine research may be said to have lasted for 70 years: 1791-1860. In the latter year, Lenoir, of Paris, produced the first practical gas engine to work rapidly and silently, with electric ignition by jumo-spark. In the years that have followed, improvement after improven . has been made until the amount of coal gas necessary to develop ignition horse power has been reduced from 100 cubic feet to 14, and even 12, cubic feet per hour. Only the principal steps in the development can be mentioned.

In 1861 Million proposed compression and the use of a compression or combustion chamber. In 1862, Beau de Rochas took out a descriptive patent of the compression, four-stroke cycle now known as the Otto.

Otto and Langen exhibited their free-piston, atmospheric engine at Paris, in 1867, and in 1876 Dr. Otto brought out his famous engine with the Beau de Rochas cycle.

In 1878 and 1879 Mr. James Robson, and in 1882 Mr. Dugald Clerk, patented two-cycle engines. In 1884 Atkinson brought out a "differential" type with the strokes of the cycle of different lengths.

In 1890, when the Otto patent expired, many firms who had been making gas engines upon other lines brought out new designs, all working on the Beau de Rochas cycle. This gave a great impetus to the sale of gas engines. With the close of the century came the utilization of producer gas for power purposes; the manufacture of large-sized units, over 600-horse power, by John Cockerill Company, in Belgium, and by Crossley and the Premier engine in England; the design of the Westinghouse throttling governor, and the Sargeant engine, with cut-off governing, the rise of the natural gas engine in large units, and the double-acting gas engine with compression in America.

The two great classes of gas engines to-day are: (1) The four-cycle or "Otto" type; and (2), the two-cycle or "Brayton" type. The former, called also the internal combustion type, with heating at constant *volume*, has only one working stroke in four, the four strokes being: Charging, compressing, firing, exhausting. The two-cycle type, with heating at constant *pressure*, usually has two cylinders, one a compressing pump and the other the working cylinder. A third type of engine which should be mentioned is the cycle with heating at constant *temperature* or Carnot cycle. The nearest actual approach to this cycle using gas is the Diesel engine.

I am indebted to the Chairman of the Committee on Gas Appliances, American Gas Institute, for most of the material contained in the above sketch of the history of gas appliances.

2. The Testing of Gas.

Among the industries conducted by public service companies, none other has been for so long a time, and in so great detail, subject to legal requirements and restrictions as the gas business. The value of the service rendered by a gas company depends upon the quality, quantity, and condition of the gas delivered. Many elements besides the energy content of the gas go to determine good or poor service. These various elements are enumerated more or less completely in many of the gas ordinances now in force. These ordinances are sometimes, therefore, very technical and detailed in character; in other cases, however, containing very meager specifications. The method of preparing such ordinances, as well as the ordinances themselves, are very various. In some cases, old ordinances, long since out-of-date, so far as their technical specifications are concerned, are still in use; in other cases such ordinances have been more or less extensively amended; in still other cases entirely new ordinances have been drawn to supercede the old; in many cases no regulatory ordinances of any kind have ever been adopted.

The process of adopting a new gas ordinance is often long and painful. No recognized single standard of quality, purity, and pressure has ever been set up. Indeed, the conditions are so different in different places that a single standard is impracticable. It was because the standard of performance demanded of gas companies in different cities and states is so different, and because so much difference of opinion existed among engineers and experts as to what could fairly be required of a gas company under a given set of conditions, that the Bureau of Standards took up about two years ago a careful study of the subject of State and municipal regulations of the quality, purity, and pressure of the illuminating gas supplied by gas companies.

A compilation of all the State laws and city ordinances in force in the country was first made, and their technical requirements tabulated. A detail study was then undertaken of the various features of such laws, and an attempt made to formulate a law that should contain reasonable standards of quality, purity, and pressure of the gas, and a reasonable set of operating requirements. In this study, a large number of the best informed gas experts in the country were consulted, either personally or by letter, and many gas plants visited by a representative of the Bureau. In this work, the Bureau has been greatly assisted by the responsible officers and members of the technical staffs of gas companies, both large and small, and by members of public service commissions, gas inspectors and consulting engineers. The Bureau has endeavored to consider all sides of the various questions involved, and has, of course, received very conflicting opinions on some questions. It has been a source of great gratification to those conducting this investigation to see the fairness and broadminded spirit shown generally by representatives of the gas companies in discussing questions which affected them so vitally; and I wish to express on behalf of the Bureau our sincere thanks to them and to all others who have assisted us so willingly and discussed with us so frankly the many important questions involved in the work.

The results of this investigation have been recently published in one of the technical circulars of the Bureau of Standards, and it is our hope that it may be of great value, both to city and state officials and to the gas industry in the preparation and revision of rules and laws, controlling the distribution and sale of illuminating gas. The position of the Bureau in this matter, as in so many others, is advisory. It has no equal authority to enforce its conclusions, and no disposition to suggest federal legislation or regulation. It acts as an unbiased, coordinating agency, to formulate the concensus of opinion of those best qualified to express opinions on technical questions of great practical importance. If the work be well done, it will carry great weight; otherwise, very little.

A second investigation is in progress, and will be embodied in a separate publication. It will have to do with the methods and instruments employed in testing gas for its heating value, its photometric value, and its chemical purity, as well as in testing meters and measuring gas pressures. This will be designed to assist gas inspectors and engineers in determining whether the gas meets the specifications under which it is sold. A large amount of experimental work is being done at the Bureau, in testing methods and instruments, and in some cases improving both methods and instruments, and the results of this work will be ready for publication, it is hoped, some time within a year. This circular will be much more comprehensive than the "Notification of the Gas Referees of the City of London." The latter is accepted as authoritative, not only in London but also elsewhere, to some extent even in the United States. It is hoped that the publications of the Bureau of Standards on gas testing may come to be regarded as authoritative and may prove of real value to the gas industry. To this end the Bureau is carefully studying the various questions involved, and seeking advice and information from many sources.

Candle Power Measurements.—The candle power of a gas refers to the candle power of a luminous flame as the gas issues from a specified burner at the rate of 5 cubic feet per hour. This is measured by comparison with some kind of flame standard, candles being the most used but least reliable standard. The pentane lamp is probably the best flame standard in use, in spite of its serious limitations. Oil lamps may be used safely if only moderate precision is required, provided they are frequently calibrated and used with care. But, inasmuch as mantle lamps are so largely employed in lighting, and a high candle power gas is not necessary for them, less importance attaches to photometric tests for bare gas flames than formerly, and less stringent requirements may be made as to the candle power of the gas so measured. It is thus possible to obtain a given heat value and a better lighting service when using mantles at an appreciably smaller cost of manufacture of the gas, but although the photometric testing of gas is less important than formerly, the photometric testing of gas mantles and of other lighting appliances is more important than heretofore. The gas company can do much good by encouraging the use of good appliances, and many of the larger companies have adopted very progressive methods in this respect. The public needs information as to the best use of light (both gas and electric) in homes, in stores and factories, in public buildings and on the streets, and the lighting companies can do much good in this direction.

Tests of Gas Appliances for Heating, Cooking, and Industrial Uses.—Immense varieties of gas appliances are used for household and industrial purposes, and here again the gas company can do much good by encouraging the best and safest, and setting a high standard in the matter of connecting such appliances. The committees of the American Gas Institute and the National Commercial Gas Association on gas appliances have done excellent work in this direction, and no doubt will continue even more active than in the past. The standardizing and testing of such appliances and materials used in connecting them, and the careful determination of their efficiency and performance, are quite as important and practicable as the measurement of the efficiency of gas burners or mantles.

Tests for Impurities.—It is very important to have the gas free from such impurities as sulphur compounds and ammonia, and tests and penalties are usually prescribed to insure reasonable freedom from such impurities. Gas companies find it to their advantage to comply with such requirements, the tests are easily made, and they offer comparatively little trouble in the administration of the law. It would be desirable, and to the interest of the gas companies, if still greater freedom from these impurities could be economically attained.

Gas Pressures.—One of the most important features of good gas service is a nearly uniform pressure, neither too small nor too great, and yet the tendency is toward higher pressures. It is also one of the most difficult conditions to meet, as is likewise the case in the distribution of electricity for lighting purposes. In both cases, heavy mains, feeders, boosters, and storage tanks or batteries are or may be employed to aid in maintaining steady pressures. But whereas the gas company enjoys an immense advantage over the electric company in its gasholders, it suffers a disadvantage, due to the clogging of service pipes, and sometimes to differences in altitude of different parts of a city. Heating as well as lighting appliances require adjustment to suit the pressure, and after such adjustment has been made serious variations of pressure are detrimental to efficiency, and may even be dangerous. Hence pressure limits are set in regulatory ordinances, and measuring the pressures at various parts of a city is one of the duties of a gas inspector.

3. The Measurement of the Heating Value of a Gas.

Gas is used for the production of heat, light, and power. For heat and power, and largely for lighting as well, its value is determined by the amount of energy it contains, and by its condition as respects pressure and purity. Its energy is measured by burning samples of the gas in a calorimeter. For this purpose, several different forms of instruments are available. The able Committee on Calorimetry of the American Gas Institute has done very valuable work in testing different forms of calorimeters, and in showing how they may be used in giving reliable results. The Bureau of Standards has also been making a thorough experimental study of gas calorimeters, the results of which will be published in the "Bulletin" of the Bureau of Standards. The results of this work will enable still higher accuracy to be obtained in calorimetric work.

The Gross and Net Heat.—A gas calorimeter is an instrument for measuring the heat of combustion of a gas. In the usual type of instrument, the gas to be burned and the air to support combustion are admit-

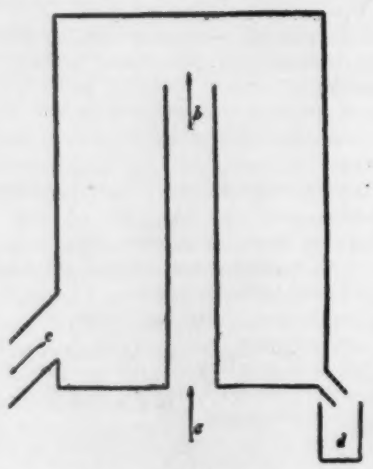


Fig. 1.—Calorimeter.

ted to the calorimeter at room temperature, while the products of combustion are cooled substantially to room temperature before escaping, these products all being gaseous except that a certain amount of water vapor is condensed and collected as water at room temperature. The heat measured by the calorimeter under these conditions is called the *gross* heating value of the gas.

If the heat of condensation at room temperature of the water vapor condensed and collected is subtracted from the gross heating value, the remainder is called the *net* heating value. Usually the gross heating value is specified in city ordinances and in rules of the State commissions (where a calorimetric test is required) and it is commonly believed (though erroneously) that it can be as accurately measured as the net value. As there is some confusion on this point and as the measurement of the heat of combustion of gas is a very fundamental problem, I may be permitted to discuss the question rather fully. In the figure, representing diagrammatically a calorimeter, the air current entering and leaving the calorimeter is indicated by arrows, while the water vapor content of the air is indicated by letters.

a = mass of water vapor *admitted* to the calorimeter (per unit quantity of gas burned) in the incoming current of air.

b = mass of water vapor *formed* by the combustion of unit quantity of gas.

c = mass of water vapor *escaping* (per unit of gas burned) with the products of combustion.

d = mass of water vapor *condensed* in the calorimeter and collected outside.

Let A = latent heat contained in a.
B = latent heat contained in b.
C = latent heat contained in c.
D = heat of condensation at room temperature of d.

The Total Heat.—We will define the *total* heat T, as the amount of heat measured by the calorimeter per unit quantity of gas burned if the air (admitted to the calorimeter at room temperature) is dry, and if the water vapor formed by combustion is all condensed in the calorimeter, and both it and the products of combustion escape at room temperature. In other words, when gas is burned in dry air at room temperature, and the total products of combustion are cooled to room temperature, and all water vapor formed is condensed to water, the heat given up in the process is called the *total heat*. Then, under these circumstances,

$$a = 0;\ b = 0;$$
$$c = 0;\ b = d.$$

and the heat measured by the calorimeter is the total heat, T. This would be the value found if the measurement were made with a bomb calorimeter. This is a larger quantity than the *gross heat* defined above, due to the fact that usually more uncondensed water vapor escapes from the calorimeter than enters with the incoming air. If the products of combustion carry away water vapor of mass c, and latent heat C, heat measured will be $T - C$. If the air entering contains water vapor of mass a, and latent heat A, then the heat measured will be $T - C + A$. But this is defined by the *gross heating* value, G. Hence:

$$G = T - C + A.$$

The net heating value N, is the gross minus the heat of condensation D, of the water deposited per unit of gas burned, d. Hence:

$$N = G - D = T - C + A - D$$
$$= T - (C + D - A).$$

But, since $a + b = c + d$
and $A + B = C + D$
$C + D - A = B$; and, therefore,
$$N = T - B.$$

That is, the net heating value of a gas is the total heating value (as defined above) minus the latent heat at room temperature of all the water vapor produced by combustion. Both the *total heat* and the *net heat* are independent of the amount of water vapor entering the calorimeter with the incoming air current or of the quantity of water vapor leaving with the products of combustion. That is to say, they are independent of the quantity and temperature of the air entering the calorimeter and of the atmospheric humidity, but depend only on the quality of the gas burned. The gross heat, on the contrary, varies with a, being a maximum when the atmosphere is saturated, and a minimum when it is dry. It also varies with c, being larger as c is smaller and vice versa. That is, the gross value varies with the atmospheric humidity, and with the quantity and temperature of the gaseous products leaving the calorimeter. If the air enters dry, and is great enough in quantity to carry away all the moisture produced by the flame, so that $d = o$, then the gross and net values are equal. If the air enters saturated, $a = c$ and $b = d$, then the total and gross values are equal.

Gross Heat Affected by Atmospheric Conditions.—Hence we see that the *total heat* and the *net heat* depend only on the gas itself, and are wholly independent of the condition of the atmosphere and of the quantity of air passing through the calorimeter (if there is enough air to insure perfect combustion). The *gross heat*, however, is a variable quantity, depending on both these factors as well as upon the gas itself. If, for example, a certain gas has a total heat of 600 B. T. U. and a net heat of 550 B. T. U., the gross heat as measured by a calorimeter may be anywhere from 550 to 600 (or may be outside these limits in extreme cases) according to the temperature and the atmospheric humidity at the time of the measurement and the quantity of air passing through the calorimeter.

It will be seen from the above that the net heating value is a truer measure of the quality of the gas than the gross. It is the gross value, however, which is used generally as a test of the quality of the gas. Hence, even if the calorimetric work be correct to within one per cent., and the net heat determined within one per cent., the result may be in error by several per cent., if the gross value is used. Since the object of the work is to test the quality of the gas, the result should, of course, be independent of the state of the weather.

The effect of atmospheric moisture upon the light of a gas flame is even greater than its effect upon the results of a calorimetric measurement, but this effect is substantially eliminated in photometric testing if a flame standard is employed. The candle power of a flame is greater in a drier atmosphere, being about 10 per cent. greater for a pentane or Hefner lamp in a dry winter atmosphere than in a moist summer atmosphere. The gas flame changes also, probably about the same amount so that a photometric measurement of a gas flame against a flame standard does not give the real candle power of the gas at the time, but does give a measure of what that candle power would be if the flame were burning in an atmosphere of average humidity. This is as it should be, for the object of the photometric measurement is to test the quality of the gas, for which the company is responsible. The gas company should obviously not be held responsible for changes in candle power due to the weather. Thus, while the actual candle power and the gross heating value both vary considerably with atmospheric humidity, the *relative* candle power and the *net* heating value are both independent of atmospheric conditions, and hence may properly be employed in determining the light giving and the heat giving power, respectively, of the gas.

Specification of Unit Quantity of Gas.—In the foregoing discussion, the heating value of a gas has been expressed as the heat produced per *unit quantity of gas burned*. This unit as commonly employed is the cubic foot of gas as a normal barometric pressure of 30 inches of mercury, at a temperature of 60° F., and saturated with water vapor at this temperature. That is to say, if the gas is measured by a correct wet meter (containing water only) at 60° F., and normal barometric pressure, there will be no correction to apply to the meter reading. Under these circumstances, the gas will contain nearly 2 per cent. of water vapor, which is taken as normal. If, however, the temperature is higher and the barometer is lower, a cubic foot of gas will have a less energy content; that is to say, a smaller heat value, for 3 reasons, viz.: (1) Because of the higher temperature; (2) because of the lower pressure, both of which decrease the density; and (3), because of the greater vapor pressure of water at the higher temperature, a greater percentage of the volume being occupied by water vapor. Hence, the heat produced in the calorimeter per cubic foot registered by the meter will be less; at 29 inches pressure and 90° F., it will be 11.5 per cent. less. This correction can easily be taken from tables prepared for the purpose, in which usually the first and third corrections are combined in one. (One is apt to infer from the descriptions often given that the correction for varying vapor pressure is not made, because it is not mentioned explicitly. Indeed, some tables do not take account of this.)

Effect of Barometric Pressure and Temperature.—These corrections enable one to determine from the calorimeter measurement the true net heating value of a cubic foot of gas, under normal conditions of temperature and pressure, and this is a measure of the quality of the gas; but the company delivers to its customers gas measured at actual existing barometric pressures, and no correction is made to the meter readings for variations in barometric pressures. The fluctuations above and below the mean barometric pressure in any given place may be ignored, inasmuch as they will balance out in the long run. But if the mean barometric pressure is below 30 inches the customer gets a less quantity of gas on that account, for the density and heating value are less in the same proportion as the barometric pressure is less than 30 inches. For example, Minneapolis is about 800 feet above sea level, and has a mean barometric pressure of 29.2 inches, more than 2 per cent. less than normal. Denver is 5,300 feet above sea level and has a mean barometric pressure of 24.7 inches, 17.7 per cent. less than 30

inches. Hence, gas that shows 600 B. T. U. as tested in Minneapolis (*i. e.*, reduced to 30 inches), would give only 584 B. T. U. if reduced to the mean pressure at which the customer gets it. In Denver, gas that shows 600 B. T. U. by calorimetric test (*i. e.*, reduced to 30 inches) gives only 494 B. T. U. at the pressure at which it is delivered to the company's customers. In Boston, New York, Philadelphia, and all cities at or near sea level, the mean barometric pressure is practically 30 inches and the present practice is perfectly correct. This suggests the obvious fact that either the heat value should be calculated for the mean barometric pressure at which the gas is delivered to the users at any given place, or the meter readings should be corrected to normal barometric pressure. The latter would, of course, be very laborious in practice unless the meters were set so as to do this automatically.

The same remark applies, of course, to the temperature. Tests are reduced to 60° F., and if this is the mean temperature of the meter, no temperature correction is necessary to the meter readings. The mean annual *outdoor* temperatures of Boston, New York, Chicago, Denver, and Seattle differ by only a few degrees (averaging about 50° F.), so that there is probably very little difference in the average meter temperatures in the cities of the northern portions of the United States. New Orleans has an average temperature of 20° higher, and hence there may be several per cent. less average heat value of the gas per cubic foot as delivered and metered to the customers in New Orleans, due to this cause alone. Buffalo and Minneapolis have somewhat lower mean temperatures than the average, and this tends to offset the effect of their lower barometer.

Two Aspects of a Calorimeter Test.—We see, therefore, that a calorimeter test of gas may be regarded from two different points of view. According to the first, the test gives the heat value of the gas per cubic foot *measured under standard conditions of temperature, pressure, and water vapor content.* The total or net value of this heat depends only on the composition of the gas, and could be calculated, if we knew its chemical composition. The gross value, as usually measured and defined, depends to some extent on the atmospheric conditions and other circumstances of the test; it is not as true a measure of the quality of the gas as the net heat.

According to the second point of view, the calorimetric test should give the heat value of a cubic foot of the gas as nearly as possible *as delivered to the customer*, and hence the correction for temperature and pressure should be, not to 60° F. and 30 inches barometric pressure, but to mean annual meter temperature and pressure of the city where the gas is sold. Then, if a uniform heat value were required, the gas would be made of enough higher heating quality in a city of higher altitude or higher mean temperature than the average, to offset the effect of smaller density. This would seem perfectly feasible except possibly for cities at high altitudes, where the difference is large, and here it may be better to make the correction either in the rate of the meter or the heat value required.

It may be urged that such corrections tend to complicate the sale and distribution of gas, and that the present methods are good enough in these particulars to be let alone, but I think this is not a correct view. What is the logic of trying to keep meters free from accidental errors greater than 2 per cent., and of trying to make calorimeter determinations correct to 1 or 2 per cent., if constant errors of 2 to 5 or even 10 to 15 per cent., or more, due to low barometer or to a higher or lower mean temperature than the average, are ignored?

To use an expensive calorimetric outfit in order to make the calorimetric determination accurate to a high degree is commendable, but to correct the result to 30 inches barometric pressure when the gas is burned in the calorimeter (and delivered to the customers) at an average pressure of say 29.2 inches as in Chicago or Minneapolis, or 24.7 inches as in Denver, is not in harmony with the accuracy of the experimental work.

I would not, of course, suggest that, in routine calorimetric measurements, an attempt be made always to apply all possible corrections; but there should be a well formulated official specification such that a given mass of gas of a given quality tested by different persons would be found to give the same heat value (within reasonable limits to cover the errors of measurement); and, also, a given mass of gas tested by the same person and the same instrument, but, under varying conditions of temperature, pressure, and atmospheric humidity, should give the same heat value.

Distinction between Volume and Quantity or Mass.—The cost of manufacturing gas is determined, not by the volume the gas occupies after it is made, but by the *mass* of the gas and its quality; and, similarly, the value of the gas to the user is determined by the *mass* of the gas and its quality. A calorimetric determination under present methods tests the quality, the meter measures its volume, and no account is made of variations in density. As already stated, the fluctuations of atmospheric pressure above and below the mean may be ignored; but the departure of the mean from the normal may be considerable, sometimes amounting to several per cent., and representing large sums of money in a large city.

A parallel case exists in the testing of coal for the purpose of calculating its value on a heat unit basis. The value of a cargo of a given kind of coal depends on two things; its total weight, and the average number of heat units yielded per pound of coal. In taking a sample for calorimetric test care is always exercised to get a representative sample, which is then sealed to prevent any change in moisture content, or other change. If the sample is dried before burning, the percentage of moisture is recorded, and the heat of combustion measured is reduced by the percentage of moisture so as to give the average heat value per pound of the coal as weighed on delivery. To dry the sample and burn it in a calorimeter, and report the heat value per pound of dry coal, and say nothing about the moisture content, would obviously be misleading, but if the moist coal is burned in the calorimeter, the heat per pound of the coal as weighed is directly determined and no separate determination or record of the moisture in the coal need be made.

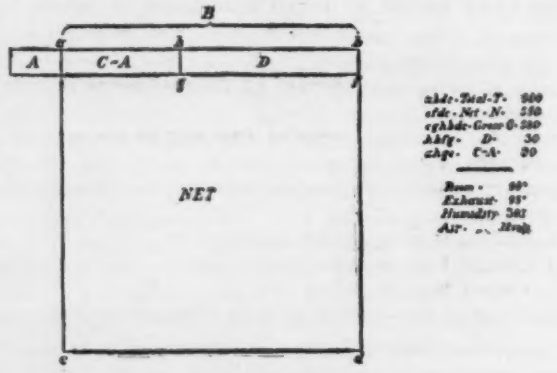
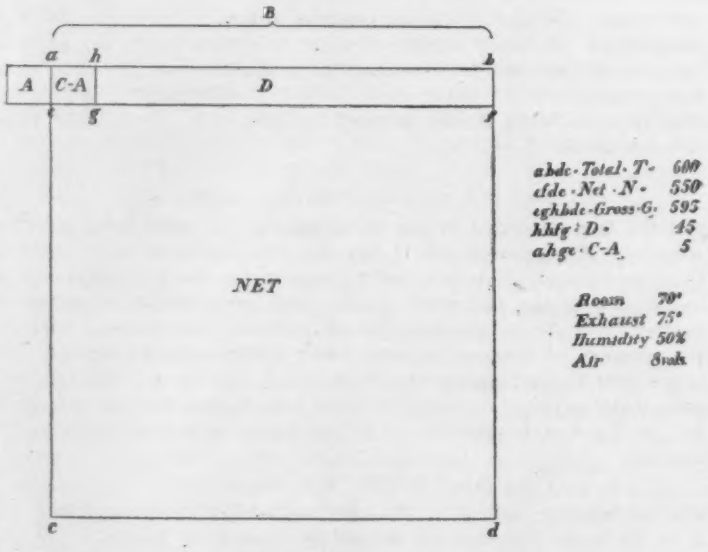


Fig. 2a.—Calorimeter.



To return, now, to the case of gas testing, it is seen that to measure the heat value of the gas per cubic foot under the condition in which it passes through the consumers' meters is what is really wanted. Of course, it is impossible to test the gas at each meter, hence the most that is practicable is to reduce the result not to 60° F. and 30 inches barometric pressure, but to the mean meter temperature and mean barometric pressure of the city where the gas is distributed. Such mean temperature and mean pressure are not difficult to determine at least approximately, and it would appear not impracticable to carry out such a method. In order to illustrate in a concrete way how the gross heating value as usually defined and measured varies under different conditions, the *total* and *net* heat being always the same for the same gas, I shall give a number of numerical examples. In each case suppose the same mass of gas is taken, the consumption being such that 600 heat units for the total heat are given off, and 550 net, when one cubic foot of gas at 30 inches barometric pressure and 60° F. (saturated at that temperature) is burned.

In Fig. 2 the rectangle *a b c d* represents the total heat, 600 B. T. U. The rectangle *a b e f* represents the heat of condensation *B* of the whole amount of water vapor formed in the flame, and *h g b f* is the part, *D*, represented by the water vapor condensed and collected.

Hence *e f c d* is the *net* heat, *N*, and *c e g h b d* is the gross heat *N + D*. When the room temperature is 90° F., exhaust 95°, humidity 30 per cent., and air passing is 12 volumes, the gross is 580 B. T. U. If room temperature is 70°, exhaust 75°, humidity 50 per cent., and 8 air volumes are used, the gross is 595 B. T. U.

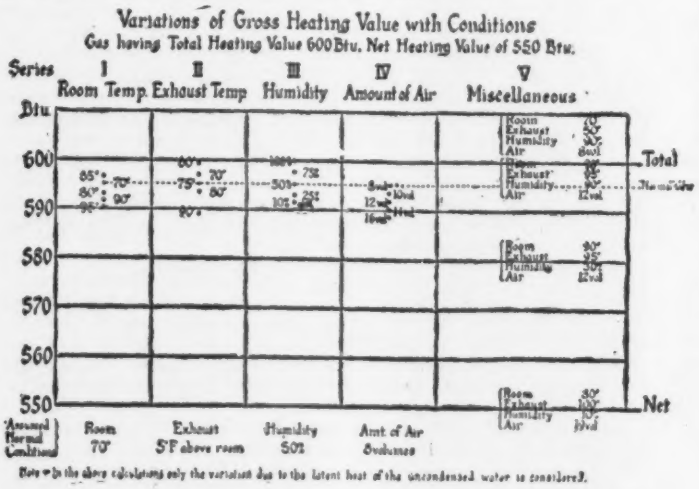


Fig. 3.—Showing Values of Gross Heat at Various Temperatures.

Fig. 3 shows the values of the gross heat at various temperatures, humidities, etc. In extreme cases, possible to realize but not likely in ordinary practice, the gross may be higher than the total or nearly as low as the net. A variation of 10 or 15 B. T. U. is, however, liable to occur even in the most careful work, due to varying atmospheric conditions.

The "Normal" Gross vs. the Net.—The above examples show that gas of a total heating value of 600 B. T. U. and of a net heating value of 550 B. T. U. *may* have a gross value anywhere between 550 and 600 according to the condition of the atmosphere and the rate at which air passes through the calorimeter, although under usual conditions the variation is relatively small. It is true, of course, that a wide range of gross value would probably never occur in any one place. Nevertheless, the specifications for taking the heat value of a gas should be so definite that the same result (within the inevitable errors of observation) would be obtained on a damp or dry day, in summer or winter. This will be true if the net value be specified, or if the gross value be specified under certain normal atmospheric conditions and a normal rate of flow of air. This would necessitate applying corrections of variations in the atmospheric humidity and for variation in the rate of flow of air, which latter is difficult to measure. Without such specifications the variations due to the atmosphere may be much more than the usual errors of the instrument, except under uniform external conditions. In much of the best calorimetric work published, where very close agreement in different determinations has been found, the atmospheric conditions have been very uniform. If work done at different times shows different heat values, the difference it attributed to the difference in the gas. At the Bureau of Standards atmospheric differences have been made intentionally, and the differences in the gross heat appeared at once.

It is very difficult indeed to measure the quantity of air flowing through a calorimeter, and if one varies the position of the calorimeter damper the rate of flow of air varies considerably. It may be possible to determine approximately, by careful investigation, the quantity of air passing through a calorimeter for a given rate of burning of a given gas, and so fix a basis for correcting the gross heat to a normal gross. Instead of attempting to specify the rate of flow of the air it is more usual to operate the calorimeter so as to obtain the highest gross value possible, but this maximum value will vary under different atmospheric conditions. Sprinkling the floor of the calorimeter room to raise the humidity and decrease the temperature of the atmosphere will increase the gross heat; raising the temperature of the room without such sprinkling will lower it. But neither operation would have any effect on the net value.

If instead of correcting the variable gross value to a constant "normal" gross we specify the total heat as defined above, we must correct the measured gross by adding C—A. That is, we must add the difference in the latent heat of the water vapor leaving the calorimeter and that entering it. This also requires a knowledge of the atmospheric humidity and the quantity of air passing through the calorimeter, and hence is not an easy correction to apply.

If, however, we specify the *net heat* of the gas, we require no knowledge of the atmospheric humidity or the quantity of air entering the calorimeter. We must, of course, have enough air to insure complete combustion, but an excess does little harm. For while an excess decreases the gross value measured, it also decreases by the same amount the correction D subtracted from it, thus leaving a constant difference, the net heat, *the only quantity that can be readily measured unaffected by atmospheric conditions.*

[No argument is here made for the net heat because some of the gross heat of the gas is not utilized in ordinary gas appliances.]

Shall the Actual Net Heat be Substituted for the Gross?—If it is granted in view of the above considerations that the net heat is the proper quantity to specify as indicating the quality of the gas, the practical difficulty remains that in many ordinances and rules a gross value of 600 B. T. U. is now specified, and it is difficult to change established practice. Even if a change could be readily made, 600 B. T. U. sounds better than 550 and some feel that the latter figure does not give the gas manufacturers credit for all the heat they have put into the gas. This difficulty, and the practical difficulty of changing established rules, can be largely overcome by allowing the gross value of 600 to remain in the rules and ordinances, but to add by way of amendment that *for purposes of test* 550 B. T. U. net (or whatever is found to be equivalent) shall be construed as equivalent to 600 gross. This would give at once a fixed standard, more satisfactory than the present gross or even a normal gross, and would at once remove one of the most serious objections to the present practice of gas calorimetry. To correct the measured net heat to the mean annual meter temperature, and mean annual barometric pressure of the city where the gas is distributed, instead of to 60° F. and 30 inches barometric pressure (or to omit the correction for barometric pressure altogether) would be the next logical step in putting the calorimetric testing of gas on a more scientific basis. These two changes are, however, too important and too far reaching to expect that they could be agreed to and put into practice immediately. I suggest that a committee of the American Gas Institute, working in co-operation with the Bureau of Standards, might give the matter careful study, and report their findings to the Institute and the public. I believe that the Institute and the gas interests at large would favor the adoption of such changes in practice, if, on careful study, they appeared to be just and practicable. To do so would be in harmony with the present tendency to adopt uniform standards of gas quality, so that 1,000 cubic feet of gas would mean the same thing in actual service as nearly as possible in different places. No criticism is intended that such changes have not been adopted before. But now that instruments are more accurate and methods more perfect and requirements more exacting than ever before, we should be as careful in taking account of the varying density of the gas as we are in measuring its volume and quality.

The Bureau of Standards has not suggested these changes in current practice in its recent publication, but in the next publication on testing methods these questions will arise, and in studying them we shall hope for as cordial co-operation from the gas interests as they have given us in the first investigation.

[Continued from Page 421.]

PROCEEDINGS OF THE EIGHTH ANNUAL MEETING, ILLINOIS GAS ASSOCIATION.

Held in the Auditorium Hotel, Chicago, March 20 and 21, 1912.

Second Day—Morning Session.

The President announced the first business would be the presentation of the names of

Added Applications for Membership.

Active—Dowdy, W. C. Glenn, R. B. Ricker, S. J. Riefstal, L. V. Zitewitz, W. R P.

Associate—Kline, B. J. Schutt, H. L.

On motion of Mr. Negley, the Secretary was instructed to cast the ballot for the election of the gentlemen named. [The Secretary subsequently reported that he had complied with the instruction.]

Report of Committee on Standards of Service, Etc.

The President—Next comes the report of a temporary committee. At the last meeting a motion was carried that the report of the Public Relations Committee (made a year ago) be adopted, and that a committee, consisting of one member each from the Technical and Public Relations Committee, be appointed to continue the investigation on standards. As the Chairman of the Committe is absent I will read it:

The Committee was instructed to confer with all of the Companies in Illinois on these general questions, and alse to investigate the work done by the various State Commissions along these lines, and to make a full report as to the practice most suitable in this State, from the standpoint of absolute fairness to both the companies and the public.

Section 1.

Standards.—A circular letter was addressed to the Public Service Commissions of Georgia, Kansas, Maryland, Massachusetts, New Jersey, New York (1st District), New York (2d District), South Carolina,

Vermont and Wisconsin. Full replies were duly received from the Commissions of Maryland, Massachusetts, New Jersey, New York (1st District and 2d District), and Wisconsin. The Georgia and Vermont Commissions stated that they had taken no action along these lines. The Kansas Commission replied that their authority did not extend to these subjects. No reply was received from South Carolina. Under Standards of Service, 10 questions were asked and both questions and answers may be summarized as follows:

1. "Candle power requirements, if any?"

The Maryland Commission has not definitely fixed requirements affecting the manufacture and supply of gas generally throughout the State, but has temporarily accepted certain existing conditions. There is a local standard of 20-candle power fixed for the supply in the town of Easton, and this has been temporarily accepted as the standard of candle power for water gas, 16 to 18-candle being allowed as a standard for coal gas. Massachusetts requires 16-candle power minimum. New Jersey and Wisconsin have no requirements. The First New York District (New York City only) requires 22-candle power. The Second New York District, covering all the State outside of New York City, requires 20-candle power for water gas, 18-candle power for mixed gas, and 16 candle power for coal gas, the test to be made at a distance of not less than 1 mile from the distributing holder, using either a new style F. Argand burner, old style D. Argand burner, or No. 7 Slit-Union Bray burner, as may be best suited to the gas to be tested.

2. "What is the heat unit requirement, if any?"

Maryland has accepted for the present a heat unit requirement running between 550 and 600 B.T.U. per cubic foot. Massachusetts has no requirement. New Jersey and Wisconsin have adopted the following rule: A company furnishing gas which, within a 1-mile radius from the distribution center, gives a monthly average total heating value of not less than 600 B.T.U., with a minimum which shall never fall below 550 B.T.U., may be considered as giving adequate service as far as the heating value of the gas is concerned. Neither district of New York has any heat unit requirement.

3. "What is the H_2S requirement, if any?"

Maryland has no standard requirement. Massachusetts entirely prohibits. New Jersey and Wisconsin limit H_2S to a trace. New York (1st District), no requirement; New York (2d District), required that lead acetate paper shall show no color after exposure for 30 seconds to a jet of gas flowing about 5 cubic feet per hour.

4. "What is the total sulphur requirement, if any?"

Maryland and both districts of New York limit to 20 grains per 100 cubic feet of gas. Massachusetts, New Jersey and Wisconsin limit to 30 grains.

5. "What is the ammonia requirement, if any?"

Maryland, New Jersey and Wisconsin have no requirements. Massachusetts and New York (2d District) limit to 10 grains; New York (1st District) limits to 5 grains.

6. "What is the pressure requirement, if any?"

In Maryland there is no specific requirement as to pressure, inasmuch as it was considered that it would be difficult to establish a definite range of pressure different from that existing in various localities, owing to difference in elevations. In Baltimore, the supervision of pressure is with regard to a minimum of 2½ inches and a maximum of 4½ inches water pressure. Massachusetts and New York (1st District) have no requirement. New Jersey and Wisconsin require that the gas pressure as measured at the meter inlets shall never be less than 1½ inches nor more than 6 inches of water pressure, and that the daily variation of pressure at the inlet of any one meter on the system shall never be greater than 100 per cent. of the minimum pressure. New York (2d District) has no requirement, except for cities having a population of over 50,000 and less than 175,000 people, in which cities it is by a special law required that the minimum pressure of gas, which shall be permitted in any service main, shall be sufficient to balance a column of water 1½ inches in height; the maximum pressure shall be an amount sufficient to balance a column of water 3½ inches in height, plus an allowance at the rate of 1 inch for variation of each 100 feet of increase in altitude in the distributing system, between the holder and the point of consumption, except that no maximum pressure shall be prescribed in service main, the pressure of gas from which is regulated by service governors, supplied and maintained without charge to consumers.

7. "Is there any requirement for periodic removing and testing of gas meters, and what?"

In Maryland generally there is no requirement as to periodic removing and testing of gas meters. In Baltimore meters are removed and tested at 5-year intervals. This is a matter which is now under consideration. Massachusetts and New York (2d district) have no requirement. New Jersey required meter changes every 6 years; New York (1st district), every 7 years; Wisconsin, every 3 years.

8. "On removal of meter on complaint, within what limits is meter considered correct?"

In Maryland a gas meter is considered in error if it records more than 2 per cent. to the prejudice of the consumer. In Massachusetts, New Jersey, New York (1st district and 2d district) and Wisconsin, it is considered correct if within 2 per cent. either way.

9. "Is there any other service requirement?"

Maryland and both districts of New York have no other specific service requirements. Massachusetts companies are required to report annually the average candle power supplied. In New Jersey and Wisconsin frequent measurements of pressure and pressure variations are required; also, permanent records of meter tests and pressure tests are required to be kept and a permanent record of complaints received, including the address of the consumer, and the date and nature of the complaint and the remedy.

10. "Is the Commission considering any change in the above requirements?"

In Maryland, as already stated, the rules are not yet specific. The Secretary of the Commission states that in general the aim will be not so much to cause changes in the requirements, which have been found reasonable and proper by experience, as to gradually fix requirements, which will be adapted to the different kinds of gas plants in the State, bearing in mind that the second city in Maryland has a population of 23,000. Massachusetts, New Jersey and Wisconsin are considering no changes at present. New York (1st district) is considering reducing the period of testing meters to 5 years; New York (2d district) is conducting an inquiry into the advisability of heat unit standards for the measurement of gas.

Testing Apparatus and Testing Methods.

Maryland.—Daily tests, made of the gas supplied in the city of Baltimore and suburbs, consist of the measurement of candle power, determining the heating value of the gas, the total sulphur and ammonia, and a record of pressures by recording gauges located at 5 extreme points in the city, the whole representing maximum, minimum and presumably average conditions.

Outside the city of Baltimore the tests thus far have been confined to the determination of the heating value of gas at certain particular works, but have not generally been applied throughout the State. Samples of gas were taken at the time the calorimeter tests were made and chemical analysis made thereof. The results were then compared with the chemical analyses taken in all of the works where calorimeter tests were not made. All of the gas plants have been visited and reports made upon the conditions, especially those affecting the operation of the works. Nearly all of the companies now have meter provers. Some very small companies have preferred to have their meters tested in Baltimore before being shipped to the company. This is not regarded as entirely satisfactory because of the possibility of change in the accuracy of the meter, due to shipment. At the same time the procurement of proper testing appliances by very small companies is often a serious matter to them financially. The meter provers located throughout the State are generally being standardized by a standard bottle of the Commission.

Massachusetts.—Every gas light company, which annually manufactures more than 15 millions cubic feet of gas, is required to provide and maintain a suitable room at least a ¼ mile from the gas works, provided with a disk photometer and testing apparatus of a construction approved by the Board of Gas and Electric Light Commissioners, which shall be open to the inspectors and assistant inspectors on every working day from 8 o'clock in the morning until 6 o'clock in the evening. Every gas light company with a capital paid in of $100,000 or more, and every other gas light company, if required by the Board of Gas and Electric Light Commissioners, is obliged to set up, at some convenient place on its premises, one or more meter provers, of a size and type approved by the Board and tested and calibrated by the Board, by means of which meters may be tested. Two tests in relation to all the standards of quality and purity required are made annually by the official inspectors in cases where the company supplies more than 50 consumers, and such additional inspections are made as the Board of Gas and Electric Light Commissioners may determine. No requirement for making tests by the companies is imposed upon them, and they are required in their annual reports only to report the average candle power supplied. All photometers are checked, reverified and used by the official inspectors. Meter provers, which have been calibrated and sealed by the official inspectors, are used by them, when meters are tested upon the companies' premises. In the case of companies too small to be covered by requirements stated, the official inspectors use a portable photometer, devised by the inspection division. When the gas of any company is found on 3 consecutive official inspections, or on 3 inspections within a period of 30 consecutive days, to be of less than the standard candle power or below the standard of purity fixed as to sulphur, ammonia, and hydrogen sulphide, the delinquent company is required to pay a fine of $100, unless such delinquency is, in the opinion of the Board of Gas and Electric Light Commissioners, due to unavoidable causes or accident.

New Jersey.—Each gas company is required to provide itself with equipment necessary for testing meters, such equipment to consist of a standard meter prover with suitable accessories, each prover to be inspected by the Board of Public Utility Commissioners and furnished with an inspection tag or plate; provers to be set up permanently in the location where they are to be used, and to be tested by an inspector of the Board, using a standard cubic foot bottle, which has been previously calibrated and certified by the National Bureau of Standards, Washington. Each gas company is required to make without charge a test of the accuracy of a meter upon request of a consumer, provided such consumer does not make a request for test more frequently than once in 6 months. A report giving the result of such test must be made to the consumer and a complete record of such tests must be kept on file in the office of the company. Upon formal application by any consumer to the Board of Public Utility Commissioners and a fee of $1, a test of the consumer's meter is made by an inspector employed by the Board, the fee to be retained if the meter is found slow or correct within allowable limits, and to be returned and paid by the company at fault if the meter is found to be fast beyond the limit. Upon such applica-

tion and deposit of fee the meter is to be removed by the company and tested by the inspector, using the nearest certified prover. In certain cases, tests may be made with a portable test meter, but should the accuracy of such test meter be disputed, the test made by the prover shall be considered the correct one. Every gas company whose output exceeds 20 millions cubic feet a year, is required to equip with a standard calorimeter outfit, constructed and certified and approved by the National Bureau of Standards, with which periodic tests upon the gas are to be made, a record of which test, must be kept on file in the office of the company. The Board recommends that an inspection meter be kept on display in each commercial office, maintained by each gas company.

New York, First District.—The First District of New York covers only the city of New York. Its standards and methods, therefore, concern only large companies, supplying gas of a mixture and quality determined largely by past usage. These companies are all supplied with full laboratory equipment. The only specific requirements of the Commission are for meter purposes, but the companies are in addition required to furnish the Commission with any necessary apparatus. No meters can be set, which have not been tested by the Public Service Commission.

New York, Second District.—The rules and regulations of the Second District are elaborate and drawn with great care. They are contained in two pamphlets, which may be obtained by application to Mr. J. S. Kennedy, Secretary, Public Service Commission, Albany, N. Y. These rules and practices can only be briefly summarized in this report as follows: All companies are required to maintain one or more meter provers, inspected and approved by the Commission, and provided with all necessary conveniences and located in premises adequate in every respect for the proper conduct of meter testing work. The test room must be well lighted, free from drafts, kept at a temperature of not less than 60°, and there must be facilities for obtaining hot water. The accuracy of all provers is established at the laboratory of the Commission by testing with a standard cubic foot measure certified by the Bureau of Standards. Companies, on notice from the Commission, are required to ship their provers to the laboratory to be approved. All of the testing apparatus, appliances and premises must be kept in proper repair and condition. When the prover is not in use, the bell of the prover must be raised out of the water and the sliding valve covered. The water in the tank must be changed frequently and the interior of the tank and bell kept clean, the interior of the tank, but not of the bell, may be painted. All meters are tested by the Commission, and no meters can be set which have not been proved and sealed by the Commission's inspectors. The State is divided into 4 inspection districts, except in the case of complaint meters. The fees for testing complaint meters are graduated and run from 75 cents to $10, according to the size of the meter. This fee must be paid in the first instance by the complainant, but if the meter is found to be 2 per cent. or more fast, the complainant must be reimbursed by the company. Companies that for any good reason are not yet fully equipped may send meters to the Commission laboratory at Albany for test. All expenses of removing meters for test and all transportation charges must be paid by the company. No meters are tested unless they have acquired the temperature of the testing room. The companies are recommended to avoid time lost, in having meters rejected, by previously testing all meters before submitting them to the Commission's inspectors. Any meter rejected by the inspectors must be readjusted or repaired before being submitted for retest. The percentage of accuracy of registration is not reported except in the case of complaint meters. As already stated, periodic tests of meters are not required in the Second District of New York, Therefore, the Commission testing comprises only new meters, meters removed by the companies on disuse or for repair, and meters removed on complaint of customers.

All companies producing 15 million cubic feet of gas or more annually are required to maintain photometrical apparatus approved by the Commission, of such reliability that the candle power of the gas manufactured may at all times be determined with reasonable certainty. The jet photometer is not approved, but only regulation bar photometers, the photometer to be installed and approved in the first instance by the Commission and checked for accuracy. Then, thereafter, the jet of the photometer is required to be submitted periodically by the company and tested at the laboratory of the Commission. Every photometer used for coal gas must be provided with the old style D and the new style D—Argand burners, and every photometer used for mixed gas or water gas must have in addition a No. 7 slit-union, Bray burner. No rubber tubing is allowed, but only standard flexible metallic tubing, if any. Portable photometers are provided by the Commission for testing work in the case of companies producing less than 15 million cubic feet. The full instructions to companies and rules to inspectors contain the most careful provisions for the care of the photometrical apparatus and conduct of the tests. Apparatus for sulphur and ammonia testing is provided by the Commision and carried about by the inspectors. Inspectors are responsible for all tests for candle power and for impurities; the companies are not required to make or report tests. The Commission is disposed to give companies every opportunity to improve the quality of the gas, where it is found not to equal the prescribed standards before beginning summary proceedings under those sections of the public service commission law, which empowers the Commission to begin action in the Supreme Court for the recovery of the penalties provided for the violation of the law or of the orders of the Commission. At the time each test is made the gas inspector leaves a written notice of the results with the company; a formal notice is afterwards sent from the Commission's main office at Albany, and if the company is deficient in one or more respects the deficiencies are pointed out and the company is called upon to explain the cause and to state the steps taken to prevent recurrences. Where the deficiencies continue the works and methods may be examined into by the engineer of the Commission, or the company may be summoned to show cause why the actions shall not be begun against it for recovery of penalties.

The number of complete tests at each plant is determined by the small plant output. For the year 1910 for plants producing up to 10 million cubic feet annually, 6 tests were made. For each 10 million cubic feet produced in excess of this minimum an additional test was made; the maximum number of tests, however, for any one company being limited to 26. The total numbers of tests for the year were 878. In one or more respects 295 tests, or 33.6 per cent. of the total number, showed deficiencies. The supply was found to fail to meet the requirements as to candle power in 21.8 per cent. of the tests; as to the presence of hydrogen sulphide in 9.9 per cent. of the tests; as to the maximum amount of sulphur allowed, in 6.5 per cent. of the tests, and as to the maximum amount of ammonia allowed, in 1 per cent. of the tests. The Commission considers that this system of frequent inspection, exercised in each instance without warning, is sufficient to prevent general deficiency, and that for the most part the deficiencies that occur are intermittent and comparatively insignificant. The report for 1910 states, however, that, on the part of a few corporations, there has been a serious consistent default with respect to certain of which co-operation was without avail, and it became finally necessary to proceed drastically. Proceedings were, therefore, begun, but satisfactory assurances being then given by each of the companies of compliance thereafter with the standards, further proceedings were pended pending results to be shown by further tests. The Commission states that the ability of the corporations to comply with the illuminating power and purity requirements may now be regarded as clearly established in the accumulated results of the periodical tests, covering the past 3 years. Deficiencies mainly are the result of manufacturing and distributing conditions, which ordinarily lie well within the corporate means to correct, and their correction will be insisted upon.

Wisconsin.—All gas companies having an annual sendout of more than 20 millions cubic feet are required to maintain a calorimeter and take frequent readings. This is interpreted to mean at least 3 readings a week. All companies must also provide themselves with a standard meter prover. All companies are required by the rule to make surveys of pressure and records of all tests required of gas companies must be kept open to public inspection. At present the companies are not required to report these to the Commission. The inspectors examine the records and report the tests at the time of inspection. The inspectors of the Commission make regular surveys of gas pressure and make tests of heat value in the smaller towns, where the company is not required to have a calorimeter. Where the company has a calorimeter only sufficient tests are made to insure its accuracy of the company's results. At such time the company's equipment is checked for accuracy and the methods and records gone over. The findings of the inspector are reported to the company by the Secretary of the Commission. In case deficiencies are shown to exist, the company is called upon to state what steps have been taken or will be taken to correct such deficiencies. If satisfactory improvement is not made promptly the company is called before the Commission in public hearing to show cause why a fine should not be imposed for the violation of the Commission's orders, as provided in the public utilities law.

Section II.

Summary of Opinions Received from Companies Addressed.—1. The following questions were submitted to each of the 59 companies, operating in the State of Illinois, in order that a full opinion could be obtained of the views of each official on "Standards of Service."

Standards of Service.

1. What candle power should be required?
2. What heat units, and at what point taken?
3. What pressure should be carried at the works or at some particular point in the city?
4. What test for H_2S, and amount allowed in the finished gas?
5. What test for NH_3, and amount allowed in the finished gas?
6. What test for, and amount of, total sulphur in the finished gas?
7. What test for diluents, such as CO, CO_2, or O?
8. What rules should be periodically followed for removing and testing gas meters?
9. What method should be followed in adjustments with consumers, arising from defective meters?
10. Should one follow any regular rule, regarding size of services and meters?
11. What additional rules would you suggest for benefiting the service?

What makes of the calorimeter, style of photometer and various kinds of chemical apparatus do you deem best and necessary for the satisfactory operation of your manufacturing and distribution departments?

2. The following questions were sent in addition to those above to five officials connected with larger gas corporations, to ascertain the best practice followed in "Testing Apparatus and Testing Methods:"

1st. What in your opinion is the best make of gas calorimeter for general use of gas companies of various outputs, say, those making less than 10 millions per year; from 10 to 50 millions per year and from 50 millions per year up?

2d. What make and style of photometer would be the best for companies as classified in No. 1?

3d. How extensive would the companies as above classified need to go into furnishing a chemical laboratory, and what would you consider a complete laboratory for companies as classified in No. 1?

When naming the equipment for these laboratories under each classification give the purpose of each piece of apparatus, reagents, etc. The purpose of this last question is to show as far as possible the best practice in laboratory work. Full replies were received from all addressed.

We will tabulate these answers as Results Nos. I. and II.

RESULTS No. I.

In order to illustrate scope of answers received under "Results No. I," it will be well to show the territory covered by them. Illinois has a population of 5,638,600 people (census of 1910), and of these, it is estimated 3,453,000 are either served or can be served with gas, and at present 723,000 meters are in service.

To show the representative nature of replies, received from companies:

A. 14 companies serving 132,900 population, with 16,287 meters, made no reply.

B. 11 companies serving 263,500 population, with 44,969 meters, replied with incomplete data.

C. 34 companies serving 3,056,600 population, with 661,744 meters, replied fully.

Thus satisfactory replies were received from officials representing 88¼ per cent. of the population served and using 91½ per cent. of the gas meters installed in the State of Illinois.

One large company in each (A) and (B), together accounting for 75 per cent. of the unrepresented 396,400 population served, replied and thus your committee has succeeded in obtaining quite satisfactory data on each question submitted.

RESULTS No. II.

Summarizing the results as shown by the preceding graphical analysis by sub-head, we would have:

Photometry—While it is not necessary to have a gas photometer for plants sending out less than 50 millions annually, some check on the candle power, beside the open flame jet, should prevail. While some favor the jet photometer under careful check, others place no dependence upon it, on account of its inaccuracy under varying conditions. Some cheap but reliable form of bar or flicker photometer could be individually owned or perhaps owned by several companies, who could use it in common.

For companies in Class 3 a bar photometer should be at hand, where candle power is requested by city ordinance. For standards, either candles, Harcourt 10 candle power Pentane Lamp, or Sugg F. or D. Argand burner should be used.

Calorimetry—This is quite important, and all engineers recommend a calorimeter for all classes. This calorimeter should have English Units, such as pounds, Fahrenheit and cubic feet. The metric units are confusing and give erroneous results to the uninitiated.

Pressures Recording gauges for outlet of city governor should be used by all companies. Those in Class 3 may add, as good engineering requires, vacuum, temperature and pressure recording instruments, indicating instruments such as thermometers, hydrometers and pressure gauges.

CHEMICAL APPARATUS.

Sulphur.—This probably leads and should have attention given it in all plants. What is called the New York test should be made; that is, no color on a paper moistened with lead acetate after 30 seconds exposure to a jet, flowing at the rate of 5 cubic feet per hour. Paper held at a distance of about ¼ inch. This test should be made at inlet of last box, but is probably more frequently made at meter inlet.

For class No. 3, and where otherwise required, Tutweiler apparatus for H_2S and the Referees' sulphur test apparatus for total sulphur seem to prevail.

Ammonia.—No analysis is necessary for ammonia in some States and in water gas plants.

For class No. 3, plants making coal gas, a very complete apparatus for analysis of ammonia in the gas and of the ammoniacal liquor should be at hand, if for no other reason than economical operation of the plant.

Coal, coke, oils, tar, purifying materials, flue gas, diluents and gas analyses and specific gravity determination will be taken up more fully when necessary for completion of a preliminary report.

SECTION III.

Recommendations.—After careful consideration your Committee does not feel justified in making final recommendations at this time. Furthermore, if such recommedations could be made, it is doubtful if they could be sufficiently considered at this meeting, in view of the fact that the members will have had an adequate time in which to study the report. We, therefore, recommend that the Committee be continued and instructed to present a preliminary printed report to each member of the Association within 6 months, accompanied by a request for written criticism and discussion. That the Committee be further instructed to carefully consider all criticisms and discussions received, to make a digest of the same, and present a final report at least 2 months prior to the next annual meeting, such digest and final report to be printed and forwarded to each member.

We feel if such procedure is followed that the members will be sufficiently prepared to undertake the final consideration of this matter to full advantage at the next annual meeting, at which meeting sufficient time should be set aside for the fullest consideration.

Respectfully submitted,
H. L. RICE,
H. G. STILLSON, } Committee.

On motion of Mr. Wallace (seconded) it was ordered that the report be received and placed on file, the recommendations of the Committee in regard to the continuance thereof being concurred in. [Carried.]

REPORT OF NOMINATING COMMITTEE.

The President called for the report of the Nominating Committee. This (in the absence of Mr. Harrington) was read by Mr. Wallace, as follows:

Your Committee on Nominations begs to report as follows:

For President—H. O. Channon, Quincy.

For Vice-President—W. F. Barrett, Chicago.

For Secretary-Treasurer—H. H. Clark, Oak Park.

For Directors (two years)—D. G. Fisher, Peoria; and F. W. Bedard, La Salle.

For Delegate to American Gas Institute—C. B. Strohn, Elgin.

Respectfully submitted,
A. S. HARRINGTON,
W. L. POWERS,
R. S. WALLACE, } Committee.

ELECTION OF OFFICERS.

On motion of Mr. Parker (seconded) the Secretary was ordered to cast the ballot of the Association for the election to office of the gentlemen named.

SOME RESPONSES.

The Secretary having reported the carrying out of the instructions, the President suggested the Association would appreciate a word or two from the officers-elect.

Mr. H. H. Clark—Mr. President and Gentlemen: I am very thankful to you for the honor conferred upon me, and assure you that I will give my careful attention to all of the interests of the Association. I sincerely hope the coming year will be as successful as the past. Again I thank you.

The President—Mr. Channon it gives me pleasure to inform you that you have just been elected President of the Illinois Gas Association for the ensuing year, and we would like to hear from you [applause].

Mr. Channon—Gentlemen, I thank you on behalf of myself and my Company in that you saw fit to make me your President for the coming year. I solicit your heartiest co-operation in causing the Association to have a like measure of success the coming year that it has had the past year. I think the papers this year were the best the Association ever enjoyed, and I think from the standpoint everyone will say it is the best year of the Association. I congratulate Mr. Strohn, our President and Mr. Newberry, our Secretary, who have had the work to do on the successful showing made. Gentlemen, I thank you. [Applause.]

Mr. Newberry—Mr. President, Members of the Illinois Gas Association: I wish at this time to bring to your attention some facts regarding the work of the Secretary during the past year. I think it best to bring these matters to your attention at this time, inasmuch as a great deal of credit for the present meeting is due to our worthy President, Mr. Strohn. Early in the year, your Secretary was unable to give the Association's work close attention, owing to sickness, not only to himself but to his family. Later on, along in the Fall, matters were shaping up nicely for a very active campaign for new members and the taking care of the Association's work. When the middle of December had been reached, I was very suddenly informed as to a change of management which would take place approximately January 1st. The outcome of this announcement was that your Secretary was transferred out of Illinois and into the management of the Green Bay (Wis.) Gas and Electric Company. Not knowing exactly what to do regarding the taking care of our Association's work, your Secretary first looked around at Green Bay to ascertain if the printing of the papers of the Association could be taken care of at that point; and, very much to my surprise, I found that in a city of 30,000 people, there was no lithographing company to take care of the cuts and other work of kindred nature to be gotten out in connection with the various papers planned by the Technical Committee. This matter was immediately taken up with some of the leading members of our Association, and it became a serious matter to devise some way whereby the Secretary could still carry on the work of the Association along these lines; but, inasmuch as it was impossible to do this work at Green Bay, and if carried on elsewhere by the present Secretary, would necessarily mean my being absent from my work for a period of 3 or 4 weeks, several members were suggested, who might be able to assist in this work and bring the same through to completion, but none of these arrange-

ments seemed satisfactory, until the name of our present President, Mr. Strohn, was brought forth. It was with a great deal of reluctance that Mr. Strohn was callen upon even to take hold of the Secretary's work in connection with his own, but finally he was prevailed upon to so take hold and carried the same through to completion. Accordingly, an arrangement was made to this effect, and I wish at this time to assure the members of the untiring work that Mr. Strohn has put forth in connection with the papers which have been delivered and to which you are yet to listen. Therefore, I think our Association owes to Mr. Strohn a vote of thanks for his work, not only as President but as Secretary as well, for it is wholly due to his efforts that the Secretary's work has been brought through to completion in such a satisfactory way. Gentlemen, I thank you.

Mr. Parker moved that a rising vote of thanks be tendered to Mr. Strohn for his magnificent assistance to the Secretary; also to the Secretary and other officers for their untiring zeal in the Association's favor for the year just closing. [Seconded, and unanimously adopted by rising vote.]

The President—Gentlemen, all this is very pleasing, but I feel fully repaid for all of the work that I have done in behalf of this Association. I stated to several members on the outside that I feel grateful to every member personally for the interest taken in this meeting. Our attendance was excellent yesterday, we had a delightful banquet, and I am pleased with the attendance this morning. I shall continue to render the Illinois Gas Association all the assistance possible, because I do not intend to miss any meetings as long as I keep my health. [Applause.] I would like to explain to the members of the Illinois Gas Association that a suggestion has been made regarding the term of office of our representative to the American Gas Institute. The American Gas Institute holds its meeting in October of each year, and to get efficient service from our representative, he should hold office during a corresponding term with that of the officers and directors of the Institute. It has been suggested that we cause our present representative to continue in office until the October meeting of the American Gas Institute, and that the newly elected representative to the Institute take up his duties at that time. This is a suggestion that has been made to me from the officers of the American Gas Institute, and I think it is a very good one.

On motion of Mr. Parker (seconded) it was ordered that the present representative to the American Gas Institute hold over until and including the October meeting, his successor to begin his term of office and duties at that time.

(To be Continued.)

[Continued from Page 423.]

FOURTH ANNUAL MEETING. SOUTHERN GAS ASSOCIATION.

Held in the Seminole Hotel, Jacksonville, Fla., April 17, 18 and 19, 1912.

First Day—Afternoon Session.

The President—The first paper for consideration, is that by Mr. C. A. Case of Cleveland, O., on the subject of

BETTER DOMESTIC APPLIANCES.

When this subject suggested itself to the writer, it was not without some doubt as to the aptness of the title. It seemed that it might better be entitled "Manufacture Better Appliances" or "Sell Better Appliances," but, it finally simmered down to the fact that the two latter suggestions were closely allied, and that the present caption would cover both. I mean they are allied, inasmuch as a sale or a demand for better appliances will lead inevitably to their manufacture. Unfortunately, we cannot say that the reverse is so inevitably true. To bring about a universal improvement in gas appliances presupposes a co-operation between the buyer and the manufacturers, on the buyer's part a consideration of what the manufacturer claims for his product, and perhaps suggestions for its improvement and a willingness to offer that product for sale to his customers. On the manufacturer's part it means a careful consideration of the suggestions offered by the buyer, and, if no serious technical obstacles prevent, to incorporate them in his construction. To arrive at the goal desired by both parties, then, there must be co-operation. The gas companies cannot sell them unless the manufacturers make them, and the manufacturer is not justified in making them unless the gas companies will provide the market for their sale. Consequently, the title implies "Sell Better Appliances," and the market for better appliances implies their manufacture.

Sell Better Domestic Gas Appliances—The reason for this must be obvious to everyone present. It is conceded without argument that gas companies universally desire to make the product of their plants popular with their consumers. What step, therefore, would more rapidly bring about this popularity than a careful consideration of the appliances supplied those customers; vehicles, we might say, through which the commodity is conveyed to their use.

Most of us cheerfully pay a railroad company 2½ cents per mile to convey us over various distances in a comfortable coach; but let that same company attempt to convey us over the same route in a box car, without windows and without seats, charging the same amount for the transportation, and consuming twice the time in making the journey, what one among us would not raise his voice in protest? Unfortunately, there is too much tendency to cling to the "box car" construction in gas appliances, to the primitive types that were in vogue when the manufacture of gas appliances was in its infancy, and should have become practically obsolete long ago. People are willing to pay for convenience and for time and labor saving; then, why not appeal to this vulnerable side of our customers' natures by urging upon them still more strongly the "Pullman" rather than the "Box Car" construction in the appliances they contemplate purchasing. Not from the standpoint of luxurious finish, but from that of increased durability, convenience of construction and wider adaptability to the purposes for which they are intended.

It is pleasant to contemplate the progress that is being made in the sale of some high priced gas appliances in the Southern territory, notably the installation of automatic water heaters, costing as high as $200 per installation. It is also noticeable that there is a constantly growing sale of high-priced heating appliances, in the shape of gas-steam radiators, portable heaters and expensive gas grates. It is a pleasure and a source of encouragement to note this growing tendency to push the sale of higher priced and, necessarily, better gas appliances; but there is an impression in the minds of some of us, that this tendency has not sufficiently progressed in the sale of one class of gas appliances, and we few may be forgiven if we consider that class a very important one, viz., the gas range.

The reason for this may not be hard to determine. It may be that some of us, having been in the gas business since the days when the cheaper we could furnish a gas range to the customer for the experiment, the sooner that customer would consent to make the experiment. Or, it may be that we lack confidence in the fact that in every community—at least every community large enough to support a gas plant—a proportion of the people comprising that community have a desire to surround themselves with the best that money can purchase, and who are financially able to gratify those desires. Why not cater more to this class of customers? Why not give them an opportunity to inspect the higher grade appliances and to purchase them if they see fit? But it is too often the case that a customer of this class, when he enters the sales room of the gas company he patronizes, finds a display of ranges varying in price perhaps up to $30, and buys the best one he sees. To his mind it is the best that is made, because he has seen no better; but what has he gotten? A baking oven, a broiling oven and 4 burners for cooking. He could have gotten the same capacity in a range 25 years ago.

True, the ovens are raised from the floor, and there may be the additional convenience of a warming closet, but what pitiable improvement to represent a progress extending over a period of 25 years. Is it a thing to marvel at that the gas range is so generally considered an auxiliary or emergency appliance? Is it any wonder that the plaint of the gas manager so often voices the fact that there are numberless instances along his mains where the gas range is installed along side a coal range as an emergency appliance. It is not so much the fault of the manufacturer that so little progress has been made in improving these appliances, but it is owing to the plea of the buyers of "Price! we must have stoves at a price!" and it is only of recent years that a few managers are beginning to say "Put the material, honesty of construction and conveniences into your appliances. We can induce our customers to pay the price for them." The manufacturers have been making earnest efforts to improve their appliances since they were permitted a greater latitude in the cost of construction. They have elaborated on the table stove, which is no more than the shifting of the parts of the old standard, low-type range, and without necessitating the sacrifice of any greater floor space, they have embodied the additional conveniences and economical features of warming closets, specially designed boiling, broiling, roasting, toasting and pastry ovens. With what object in view? To convince your customers that, with an improved gas range, they can do more varieties of cooking with greater economy, convenience and despatch than they have been, or ever will be, able to do with the coal range. But the manufacturer, while he can design these things, must have the co-operation of the gas companies in bringing them before the public for their approval; for, after all, the real critic of an appliance is its ultimate user.

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THE AMERICAN GAS LIGHT JOURNAL

Entered at the Post Office, New York City, as Second-Class Matter.

Published weekly at 42 Pine Street, New York City.

Telephone Call, John, 2996. Cable, Am-Gas.

A. M. CALLENDER & CO., - - Proprietors.

THOMAS J. CUNNINGHAM, ELBERT P. CALLENDER, } Editors.
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Agents—American News Co., 11 Park Place, New York City.
Lemcke & Buechner, Berlin, Germany.
Aug. Siegle, 30 Lime Street, London, England.

TERMS OF SUBSCRIPTION.

United States, Cuba and Mexico, $3 per year. Canada, $4 per year. All other countries, $5 per year.
Single Copies, 10 Cents.

NOTICE TO ADVERTISERS.

New Advertisements and changes of copy therefor should be in hand Wednesday noon of week prior to date of issue.

NEW YORK, MONDAY, JUNE 24, 1912.

BRIEFLY TOLD.

THE FOURTH "GAMBOL" OF THE SOCIETY OF GAS ENGINEERING, NEW YORK CITY.—Well, the fourth annual "Gambol"—note the greenness of the titling—of the Society of Gas Engineering, New York City, was cunningly brought off last Wednesday, the green whereon the gambolling was done being the broad acres of the Astoria Light, Heat and Power Company; that is, on such acreage sections as are not taken up generating houses a mile long and ¼ mile wide, by a gasholder the height and breadth and circularity whereof are Brobdignagian, by purifying structures that are like unto those maintained for the storage of freight cars in old Chicago, by a meter house that is like unto the plan of the synagogue—but as this is a story of that which was done there last Wednesday afternoon and evening, perhaps I'd better tell the latter story and leave the large structures speak for themselves. To begin with the members of the Society and their guests left the main offices of the Consolidated Gas Company (128 East 15th street) promptly on time—there were three other starting points as well—with perfect weather as the satisfactory condition. Chief Bradley, Master Addicks, "Doctor" Francklyn, Expert Gawtrey, Doctor Elliott, Fogg (the misty), President Humphreys, Ramsdell, of the Institute, in fact all the big and little guns were on hand, and one irreverent participator remarked at the start that the travellers looked very much on the smooth bore order. However, after a most invigorating trip over the beautiful Queensboro bridge, through Steinway and Astoria proper—where one could make the odd comparison of old farm houses and modern flat houses, virtually side-by-side, the farms were reached in order. Without much ado, the "capapie" adornment to distinguish the contesting forces—the red top caps *vs.* white caps—was donned, and the baseball contest was on. We are not sure whether this game was the continuation of the one so incontinently terminated last year by a cracking thunderstorm; but in any event the "Red Tops" put it all over the "White Caps," the final score being returned at 59 to 1. Capt. Fred Down, of the victors, was likely the chief crook in this scoring business, for despite the always manly, nearly always stentorian, efforts of "Capt." John F. Nelson—may whose shadow never grow less—and the "fairly accurate" umpiring of W. Greeley Hoyt, Down was about up to the decision, especially at a pinch. However, the game closed without any necessity for appealing to Arbitrator Bradley or Commissioner Addicks. Then came the "Terrible Tussle of Tenacious Tuggers." It must have been that the chest of Master Red Tugger, George E. Woods (who, with his good lady and their fair daughter, were booked for the *Celtic*, sailing from New York next day for a 2 months holiday in Europe) already found the ozone of the sea spurning him on to "deeds of derring do," for he and his nervy crew simply put it all over Master Tugger W. Cullen Morris' "White Caps." A lull followed (although the "wash-house" was a popular place for the next ½ hour. and then to the pit of the second 15 million cubic feet storage holder, where on the spot that the king-post should rest, were spread the tables for the mighty—to say nothing of their seats. Your representatative was scoffed at, for the rather waddling way in which he crossed from the mainland to the king posts' bed; but though the suspenders of the suspension bridge creeked and the footpath widened he got there just the same. A well served supper was enjoyed, at which session there was not the shadow of formality. Good fellowship abounded, and those who wish to prove this assertion are respectfully referred to Mr. H. B. McLean, or Mr. Phil Cross—what a misnamed man! or to that sweet singer, Mr. R. M. Kellogg; yes, and to Mr. "Eddie" North. The annual meeting of the Gas Engineers Society was then proceeded with; and it is with satisfaction we note that this sterling body grows lustier in good work and wares stronger in its resources with the passing of the years. Then for the Casino Beach theatre, which as the programme fluently informs one is "Swept by Hell Gate Zephyrs." The "playlet" bore the title of "Goats," and its ensemble is traceable for its dramatic strength to Mr. Gilbert Francklyn, to Mr. E. R. Jordan, for its "Ly-ric" number. His many friends will also be glad to know that the "incidental" music was by Mr. Peter Young. The ballet was under the direction of Mr. Wilder F. Lawrence—who could have thought it—and in this instance the "reds" again were in evidence, only this time the colors were not on the "Caps." "Harry" A. Carpenter made a "Master Principal," and let me tell you "Jim." Kennedy as an "ensembler" may not be truthfully controverted.

The "skit" was humorous to the last degree, and I'm sure all who enjoyed its rendering will concur in the verdict that 50 per cent. of the "stuff" shown in our vaudeville theaters is not within 50 per cent. of the amusement value of the show given by the gas men at Casino Beach last Wednesday evening. All the parts were well rendered, not a hitch occurred in the staging, and the entire thing was highly meritorious. Where all did so well, appropriate mention of their artistic work would cause this story to string along too long; but I'm impelled to say that the Petronius of Mr. Will. J. Clark, was absolutely letter perfect. Take, it all-in-all the 4th reunion of the Society was a complete success from any and every point of view, and the event further amply illustrated this truth that master and men in this huge corporation are not far apart. However, the recent attempt at "unifying the labor" of the Consolidated Gas Company had well shown that fact many months ago.—C."

SIXTH ANNUAL CONVENTION, ILLUMINATING ENGINEERING SOCIETY.—Mr. Joseph Langan, Assistant Secretary, Illuminating Engineering Society, informs us that the sixth annual meeting of that body will be held in the Hotel Clifton, Niagara Falls, Ontario, September 16 to 19. The programme of papers that is being arranged includes a number of notable ones which embody the results of some recent "photic" investigations. There will also be a pot pouri on miscellaneous phases of illuminating engineering.

EDUCATIONAL WORK AMONGST THE EMPLOYEES OF PUBLIC SERVICE CORPORATIONS.—The great expansion of the business of public service corporations has brought about of necessity a correspondingly large increase in the number of employees of such bodies, an increase the very nature of which decreases these more or less familiar relations between the managers and the men that existed when the work was lesser in scope and the personal factor far less in number. However, the company head, no matter in what line of business his energies may be directed, well knows that the best results are always achieved when superintendent and workmen are closest together, and in endeavoring to maintain a plan whereunder the oldtime relations may be sustained to sensible degree, has almost found a way out of the dilemma by means of the association or club principle. Under the guidance or system of procedure, education and the social side are so deftly woven that even the managers of the scheme are hard set to find where the one begins and the other ends. This is really but the repetition, on direct personal account, let us say, of the plans which govern the formation and carrying on of Associations representing an entire industry, trade or the like. Nor has this smaller devision of employee commingly caused in any sense the retarding or diminishing of the creation and spread of the larger or

parent organizations. That the corporations are welcoming this state of affairs is amply shown in their readiness to aid such movements amongst their men, for the outcome of this planning in the past has been, to put it plainly, to the benefit of the corporation. However, that is not the power which should impel or compel; further, whatever the cause the end would justify the means, since both masters and men are the beneficiaries. Leaving out the question of the good work done by the American Gas Institute in its Practical Educational Class, by the National Commercial Gas Association in work along similar lines, we may note the subsidiary welfare and social branches maintained by the Consolidated Gas Company, which provide in several ways for financial aid to the ill that they may be properly cared for, and on like account to bury the dead, and the New York City Society of Gas Engineers, not to mention other useful bodies. Again, comes that of the New York Edison Company, whose community of interest is identical with that of the Consolidated Gas Company. This large concern recently has put in practice a most extended roster. For instance, in the New York Edison Company, well over 2 0 of its employees in the commercial department attended school during 1½ hours once a week over a period of 5 months on the Company's time. The general interest in the Company, and regard for its scope and policies, are greatly augmented and sustained in the publication of an excellent monthly booklet, containing data of many sorts, well put together personal mention, general information and specials (such as personals, articles concerning the Company in general and the like) that are more or less of a Company nature. To go afield the booklet plan is well illustrated in the domestic economies of the Susquehanna Railway, Light and Power Co., the United Gas Improvement Company, the Rochester (N. Y.) Railway and Light Company, the Consolidated Gas and Electric Company, of Baltimore, Md., and several other Companies located in and about many sections of the States. Then, almost every Company in the country now has some form of Club which has to do with the social side entirely. Thousands of dollars are invested in buildings or paid out in rentals and furnishings of the latter for the sole benefiting socially (perhaps physical would be nearer the mark) of the employees. Next to personality, technical ability or "organized knowledge" is the great asset which makes possible the highest percentage of satisfied customers. As has been written by one of our greatest authors (not to quote him literally, but to read the pith of his sentiment) personality is largely assumed by associating with persons of breeding and knowledge by study, observation and application; it is with satisfaction we here note that this work of bringing employer and employed closer together has been eminently successful. Again, university extension work, night schools and correspondence courses have become deservedly popular in recent years for two reasons. First, because knowledge is a requisite of business success and educational courses are the short cuts to knowledge. One can acquire knowledge of his own business with less effort than he can any other business, provided that his own business is one in which he takes pride and in which he wishes to advance. Even a quasi-educational course in your own business is a finger point to the pathway of success, and if one's business is of a technical sort, as the gas business is, knowledge of the product and how it is made and delivered are essential. Beyond the possibility of a doubt a public service corporation can obtain great benefits by increasing its educational work, especially among non-technical commercial employees, and as these men attain the essentials covering the manufacture and supply of the product, they are enabled to meet the public with a better knowledge of the goods they are concerned in, and with a keener appreciation of the importance of the service supplied by the company and of its position in the community.

CURRENT MENTION—

At a meeting of the department heads and other employees of Messrs. H. M. Byllesby & Company, it was decided to form the "Byllesby Lunch Club," to meet once a week for luncheon. Naturally, the object of the Club is to discuss matters pertaining to the work of the Company, and to better acquaint the employees with each other. A committee, composed of Messrs. F. H. Lane, J. W. Link and H. A. Morrison was appointed to prepare the weekly programme, covering a period of 3 months. Mr. H. V. Coffy was chosen Secretary. The first regular meeting of "The Club" was held June 12th, in the German Grill Room of the La Salle Hotel, Chicago, and a feature of the sitting was a very interesting talk concerning the relations of the Finance Department to the other divisions of the Company. The Company is satisfied that these meetings will be productive of great good, not only on individual account, but to the Company itself as well.

We are advised by Mr. C. J. Connell, Secretary, New England Section, National Commercial Gas Association, that the date for its grand outing trip has been changed from Saturday, July 13th to Saturday, July 20th.

"W. A.," writing from the Bronx section of New York City, says the 12th inst. was a history making date in the annals of the Bronx Gas and Electric Company, for on the evening of that day the first monthly meeting of its employees was called to order by the Company's President, Mr. E. H. Rosenquest. That gentleman, defining the object of the meeting, explained that the current and subsequent sessions were to be held with a view to the mutual educational and social benefiting of the Company's faithful employees. It was made perfectly plain that no such thing as compulsory attendance was intended, in fact the purpose was to conduct the meetings so that the value thereof would be sufficiently plain to cause all of the employees to have the benefit of the sessions. After thanking those present, and 30 or more were in evidence, and having promised to be present at the monthly gatherings whenever it was possible for him to so do, Mr. Rosenquest placed the meeting in charge of the Management Committee headed by Mr. Ferdon, Chief of the office division. That gentleman then read a very interesting paper entitled, "The Office Routine of Our Company." He was followed by Mr. Henry von Dwingelo, of the Engineering division, whose chest measure seemed rather noticeably diminished when he had "removed from his system" the routine developed by the Company as to the placing of electric meters, which narrative also included an excellent description of the meter as a measurer, and how it performed its function in these respects. Mr. William Deegan, of the Company's gas distribution division, then introduced Mr. Lucas whose clever talk on the construction and function of a gas meter was cleverly enhanced through his dissecting a meter into its several parts during the speech of explanation. Possibly on an exhibition of the various parts of this marvel of mechanics would be closer to the mark than to say his exhibition was that of dissection. The business portion of the meeting having been terminated an adjournment to the basement was ordered, to discover where an evident leak of aromatic coffee was occurring. The leak was of that order which proved that some people are very thoughtful, for a spouting coffee urn was reinforced at a proper distance by walls of appetizing sandwiches, which soon were dismantled and reduced to a more than crumbling state.

Publications.

[All Publications, Catalogues, etc., mentioned below, are kept in our office for the convenience of our patrons.]

Valuation of Public Service Corporations.—This (the third publication on this subject to be received within as many weeks) is by Dr. Robert H. Whitten, Librarian, Public Service Commission, First New York District, published by the Banks' Law Publishing Company, New York. The author terms this volume as covering the legal and economic places of valuation for rate making and public purchase. The narration covers some 800 pages of matter, and includes a bibliography which might be called extensive, when one considers that this has only been a "live" subject for a comparatively short period.

Gas Abstracts.—The June 1st by-monthly edition of "Gas Abstracts," which are compiled in the office of the Librarian of the United Gas Improvement Company, Philadelphia, and are reprinted by the American Gas Institute, is now ready for distribution.

Industrial Lighting.—The Commercial Section of the National Electric Light Association has issued a valuable pamphlet (48 pages, 6 by 9 inches) which illustrates modern methods in industrial lighting by means of electric lamps.

Testing of Clay Refractories.—An extensive, descriptive, illustrated paper (78 pages) by Messrs. A. V. Bleininger and S. H. Brown. Technologic Paper, No. 7, Bureau of Standards.

Cement Specification, U. S. Government.—Under an executive order from the White House, dated April 30th, 1912, standard specifications for Portland cement were adopted for all United States Government service. These specifications were given in "Circular No 33," Bureau of Standards, Department of Commerce and Labor, Washington, D. C.

(*Continued from page 437.*)

Sell Better Cooking Appliances.—At least give the better class of your customers a chance to purchase them by showing one or two of the more complete stoves on your floor. Is there a clothing merchant in your town, who, because 50 per cent. of his customers wear overalls tries to compel the other 50 per cent. to wear them also? Is there a dry goods merchant, who, because two-thirds of his customers wear calico will not carry silks and satins for the remainder? Is there a cigar merchant, who attempts to compel his entire trade to smoke "Stogies?" If there were such a case in existence, and an opinion were asked of this man's business ability, the unanimous verdict of this assembly could be condensed in the one word, "Bone head."

You may perhaps think that an undue proportion of this paper is devoted to cooking appliances, and will, perhaps, attribute that fact to a personal motive. To avoid argument, we will grant that; but who is there among us that will deny that the gas range is the most universally used of all domestic appliances to-day, and who will deny the importance of that adjunct to every man's domestic establishment which prepares food for himself and family 3 times a day and 365 days of the year? Sell the best and highest priced appliances of every type by all means, but when you sell a man a water heater at $150, do not violate all the rules of proportion, by practically compelling him to take a gas range at $25. We do not question the necessity of the bath, and the desirability of hot water wherewith we take it, but persons have been known to go for weeks, for months, yes even for years without bathing and live to tell the tale, but we have no record of any human beings who survived the longer periods mentioned without eating. Sell better appliances, but let that selling be marked by consistency, and do not let our longer familiarity with the gas range breed a contempt of its importance.

Some time we are going to have electrical competition in cooking appliances. To some of us who are skeptical, that time seems a long way in the future. To others of us, who have occasion to visit the sales rooms of combination companies and see these electrical appliances exhibited, and who are told that there is some sale for these appliances, notwithstanding the heavy initial cost of installation and of operation thereafter, the arrival of this competition does not seem so remote. It is a matter of history, the "knock out" blow given the gas industry by the introduction of incandescent electric lighting. Content with the revenue derived from gas used for lighting with the old open flame, the then promoters of the gas industry rested placidly on their oars until the blow fell. Spurred by necessity they sought another field for the output of their product to rehabilitate an almost defunct industry. Cooking with gas was the field, and the gas range was the pioneer agent in this rehabilitation. Other fuel burning appliances have followed, and the development of incandescent gas lighting has largely repaired the damage done at that time; but it has taken long years in the accomplishment.

The cooking field will, in all probability, be the next one invaded by our electric competitors. Are we going to allow history to repeat itself in this branch of the gas business? Are we going to await the spur of necessity until that competition is upon us, as did our predecessors, or are we going to make a concerted and earnest effort to place in our customers' homes such improved cooking appliances as, in the way of convenience and economy, will have so converted them to the use of gas as a cooking medium, that, when that competition does arrive, it will take as long or longer to supplant that medium that it has taken gas to supplant coal, wood and oil?

Sell Better Appliances.—Sell the cheap ones; yes, where you are compelled to. But do not force a cheap appliance on the customer who would buy the best, and let every salesman or solicitor become imbued with a desire to sell each prospective customer the best appliance made in the line he contemplates buying, and in so doing every conscientious employee will feel that he is conserving the best interests of that customer, his company and himself.

Discussion.

The President—Mr. Case's paper is now before you for discussion. Mr. Schall?

Mr. Schall—I have not read over this paper carefully, and will, therefore, confine my remarks to the improvement of domestic appliances. I concur heartily with Mr. Case over his remarks on these subjects, and wish to call attention to a few of the old ideas in selecting gas stoves in the early history of the gas stove business. Primarily, all gas companies were interested in getting out gas appliances, in selling gas for consumption; naturally, being anxious to get out stoves to consume gas, they thought it necessary to install a stove at a very low price. Perhaps then they were right; but that condition is entirely changed, gentlemen, and I think we are working under a wrong impression. I believe the time has come when we should not consider the cost of appliances. Have you ever thought over the fact that the appliance most used for domestic purposes to-day is the coal stove? It is sold to the poorest class of people, yet the average price of a coal range is from $40 to $60. The people with whom you serve are people of the ordinary class who do their own work; therefore, they are the people who should have the best appliances. It will be necessary for you to put out an appliance better than the coal stove, and I think every appliance manufacturer will agree with me that the most scientifically constructed appliance to day is the gas range, bar none. It is built upon the most scientific principles, it is built for convenience; and the easiest method of selling the gas appliance is to sell a stove where you do not have to bend, where the ovens are convenient to the eye and within the reach of all. Adhering to that principle there will be no friction, and you can sell stoves from $40 to $60 as easily as you can sell them at $30. That has been demonstrated. Fifty per cent. of the output of the larger factories to-day is of the cabinet type range. Here is food for thought. What is the use of putting out a cheap appliance to the poorer classes of people when you can sell them a standard appliance, not an auxiliary one, something that will take care of all their work and eliminate other appliances. Mr. Case refers to electric stoves as possible factors concerning the gas stove business of the future. Last October there was an article in "The Saturday Evening Post," which was written by a very clever writer. He produced figures to substantiate his article, and it seems that electric companies to-day have been considering the question as to whether they could not sell their day load at any price and count it as profit, for the reason that their peak load came at a certain period of the day. If they could secure an even load during the 24 hours (say perhaps 18 hours) of each day, they could afford to sell current at from 2 to 4 cents per kilowatt. A large firm of bond dealers in New York got hold of this correspondence, and sent it to a great many syndicates. One of the syndicates, referring the correspondence to me, asked if I would give them my opinion on the subject. The bond house people said they always considered gas securities as the most stable thing of any in the market, but if the writer's article was correct they were afraid it would have material effect upon gas securities in the future. My reply thereto was this: I said I had always been educated along the lines that there were so many thermal heat units in a pound of coal which developed from it in the manufacture of gas product 80 per cent. efficiency, that we always understood from the electric current we derived about 25 per cent.—approximate not actual figures—that in the construction to-day of electric fuel appliances they had to depend upon thermal principles, in order to bring it to a point where it would bring the cost of operation to the consumer at a nominal figure. I said the same principle applies to the gas stove business. If it were possible to build an electric stove upon a thermal basis, it was certainly possible to build a gas stove upon the same principle, and the same relative difference between a ton of coal as applied to the gas industry and electrical industry would apply as in the first instance.

The President—Mr. F. G. Dean.

Mr. Dean—I don't know what could be said in reference to Mr. Case's paper, except to indorse all he says and try to emphasize it a little further. It is a subject beyond discussion along any other lines than those of emphasis. He says that on the manufacturer's part it means a careful consideration of the suggestions offered by the buyer, and fear that many of the suggestions so offered the officers would not be very willing to pay for. That is a reason we don't have better made gas ranges or ranges made of better material. Mr. Case refers to box car construction, and further along he refers to "Bone head." A great many ranges are built on this box car principle covered with paint—some call it baked Japan—but the box car is back of that paint just the same, and the price demanded by the buyer is the cause for the box car. The author refers here to a higher priced and necessarily better gas appliance. Has it ever occurred to anybody that we are getting a higher priced range in the cabinet that is becoming so popular? Did it ever occur to you that the material used in a cabinet range is used in the box car type, and that a great many gas ranges are being sold of cabinet type at $25 to $30, that are only box car ranges? No doubt, there is something worth considering. As to selling gas ranges to poor people, well I have heard it said many times. I can't afford to buy a gas range; they only last 2 or 3 years, and then they are all rusted out. Now, I can't see any reason why poor people who cannot afford to buy gas

ranges every 2 or 3 years should have forced upon them box car gas ranges. I think, of all people they are the ones to have better and more durable gas ranges than people who can afford to buy every few years. A short time ago being called to investigate a case where another manufacturer had quoted a price on a range that was well known to the trade—a certain numbered range very well known. My employers asked me to see the range and ask why they were selling 50 cents under our price at least. I went to see the party who had the same. He said, "Well, there is the range; you know that range as well as I do." "I know the range; yes. There is the same number plate, and the same name plate, the same valve, same manifold, and same exterior finish; everything is there. I cannot understand it. I know that range costs more money to build." I opened the oven door. He said, "You needn't go any further." Looking into the oven I found it had been stripped. There was the reason that range sold at a low price, and that the buyer was to blame—simply because through asking a much less price than he had been paying us, he found a manufacturer who would take a regular name and regular number and make him a skin stove. If there was not this demand on the part of the buyer for these box car stoves, you would not find them on the market. I think a lot of stoves won't stand the durability test, and durability is just about as much as a top burner or oven test, perhaps more. There is very little difference in the quantity of gas consumed as between ranges of one manufacturer or another. The necessity for consuming a fixed amount of gas will not vary. I don't think I would want to say, as suggested by Mr. Case, that many dealers in gas appliances are "bone heads," when it comes to the question of the advisability of selling a better gas range as against a box car range; but I have my ideas on the subject. It isn't always the range built of the very best material that is the best range for the manufacturer to sell. Yet, lots of ranges made of the very best material, will cost the manufacturer a lot of labor and a lot of dissatisfaction on the part of the consumer. It means trouble and spells trouble, simply because the materials are put together in a manner, that, if anything is to be done in the way of cleaning or re-adjustment, they are so hard to get at. I have had some experience in the re-adjustment and cleaning of gas ranges, and if there are any fitters in this room, I think they will agree with me that many ranges made of the very best material are so put together that it is very hard to reach the interior when a stoppage of the pilot light or whatever else it may be, makes it necessary to take them apart and clean them.

Mr. Case—There is a little misconception on Mr. Dean's part, that I fear may find lodgment in the minds of other good men. I did not refer to any of the gas managers as "bone heads." That was the opinion they might have of the man in the mercantile business who might attempt to run his business along those lines.

Mr. Hunter—Having had the pleasure of listening to 3 of the leading lights from the manufacturer's end of it, but realizing that we of the gas end, unless we say something ourselves, will hear what we hear when they come to see us, I am going to say something, inasmuch as I have had the pleasure in having a virgin field in selling gas appliances. To a certain extent the gas manager is neither more nor less than a purchasing agent for the consumer. If we sell the consumer a stove, which shows at the end of a year as rusted out, we are going to hear from it. If Mrs. Jones telephones the gas manager at 6:30 that there is something wrong with the oven, that she can't bake biscuits, and we send a fitter up there that same gas manager is going to hear from it. When I first opened in our little town, by actual count 12 gas stoves were in use. A friend advised us not to sell any hot plates. The first year I endeavored to find a stove that was as reasonable to the consumer in the matter of price as I possibly could. Last year I ordered a carload of these stoves, 12 being of the elevated oven type, and 6 were there of the elevated type with warming closets and shelves. I re ordered 4 times for the elevated ovens and stoves with warming closets, and I have only sold the last of my old-fashioned ranges 2 or 3 weeks ago. This year I have on my display floor a single oven and double-oven stove of the old pattern, and another stove that sells as high as $65, and I haven't sold a $20 stove yet. We sold 365 cooking appliances in a little over a year. In my opinion, as small as it may be, the gas manager who pushes the sale of a cheap appliance is cutting of his supply of customers. The consumer will say there is no use buying a gas stove because it rusts out, and another one will say there is no use buying a gas stove because, "When that gas man came up here to fix it he broke it, and the gas company has not fixed it yet." We have in our little town 60 automatic, instantaneous heaters. That is small when you stop to figure a real large plant, but I have got only 218 meters, and, comparing the price of electricity and the possibility of cooking stove, I have got an 8-cent electric rate. I get $2 per 1,000 for illuminating gas and $1 per 1,000 for fuel gas. I have 197 heating apparatuses in my town, and in every one we have endeavored to sell to the consumer an article that he could use next year as well as this year. A stove that will last is a stove that will make friends for the gas company and possibly for the gas manager.

Mr. Zeek—Perhaps I failed to get the drift of the writer of the paper or of the speakers who followed him. If they build a range, putting poor material into it, and believe we won't "Jew" them down on the price, they are going backwards. We are going to get those ranges as cheap as we can as purchasers; on the other hand, particularly from the paper read this morning, and the papers in general before Gas Associations, gas men are very much alive to the need of giving their customers the very best they can have. About the only point I see in that, as applying to gas men as a criticism is a remark as to where the gas men place their emphasis. I know that in striving to get special appliances and attempting to have the change made according to our views is rather difficult. Mr. Hunter says that many suggestions were made, but the purchasers were not willing to pay for them. I guess we will have to co-operate in this. We will have to buy something. We don't know the thing that they know is right, and they will have to make a few things which they don't think are right to satisfy us.

Mr. Rushin—I wish a manufacturer or traveling man was present who had the nerve to tell how many purchasing agents for gas companies they called on knew anything at all about what they are buying. I don't favor eavesdropping, but when "standing around" when a fellow is saying something I try to hear it. Last fall I heard a purchasing agent for a large syndicate tell an appliance man that he didn't care anything at all about quality; what he wanted was price. If you have the best price you get the business. Now, that is suicide to the gas business; yes, murder. How can anybody expect the goodwill of customers when they talk about them in such a way as this? It is a disgrace to the gas business. In trying to make my company buy appliances, the first thing I ever say is "quality." I want something good, the price comes next. Of course, we all, like the gentleman from Florida, want everything as cheap as we can get it; but we want something good. It is a pity, but if more gas men knew more about what they were buying, if the merchant Mr. Case spoke of, knew as little about what he was buying as some gas men know what they are buying, certainly he would be a "bone head." That is unfortunate for the gas man. I favor high class appliances, as you all know, for you heard Mr. Congdon this morning read my letter, in which I dwelt upon this a little. I said so at every National Commercial Gas Association Convention I attended save Denver. There I had an axe of my own to grind, appliances were not in my mind at that time; but, if you want to get and keep the goodwill of your customers, you must give them something good and with value received for the money you receive from them. Of course, this applies to gas appliances and gas, but I am not talking about gas right now. Every purchasing agent for a gas company should come personally in touch with the consumer, so as to secure knowledge of what the consumer wants if not needs. Really it is an easy matter for a salesman to sell a person what the latter really wants and needs, if he will only take the time to explain to that party the minute details that go in selling. If that gas man tried as hard to sell our customers as the appliance man tried to sell us, we would have better satisfied customers, because I don't think that more than 20 per cent. of gas men abuse the appliance man; it may not be any more than that of the consumer abusing the gas man. The electric people are ahead of us in that they try to sell higher class and better appliances than the average gas man. At any rate such is my observation in attending the convention, and meeting the electric and gas men. The appliance business is a hard one to get at properly or to know what should be done. The National Commercial Gas Association has a committee working out standard appliances, and if it does its duty, you will see better appliances in the future from the results. Gas companies made a mistake at the beginning in trying to give something away to induce people to buy gas, and I am sorry to say that a great many of them haven't got away from that idea yet; they want to give the fellow something to make him buy gas. That is altogether a mistake. We can make money by buying good appliances and selling them at a fair profit to our customers. I have not yet heard of a gas company that is maintaining its new business department by selling appliances with enough profit to pay all of the ex

penses of such new business department. When this condition comes about, better appliances will be sold. The average gas salesman goes the way of least resistance, and it is easier to sell a man a $16 stove than it is a $50 one. If all gas companies adopted the commission way of paying salesmen so much per dollar on appliances sold, they will kill this "least resistance." Human nature is alike the world over, and the man selling anything on commission will sooner sell the appliance on which he makes $3 than on the one he will only make $1.50. The way to overcome collections on that is to make that salesman partially responsible for the payment of that appliance. Personally, I will be glad when the time comes that we won't sell any more low oven ranges, that they are all to be of the cabinet type and made of just as good material as it is possible to use. This goes with everything that burns gas, from tip to a gas engine. Doing that, and meeting the public half-way, you are on the right road to having the goodwill of every consumer of this city. All over the country right now one may see a wave of domestic science cooking courses in all our high schools and female colleges. There are manufacturers who have taken up the line of making these appliances. For instance, on a little hot plate rests a little tin oven. For the demonstrator there is a range. I went into a wealthy college last fall, where, very much to my surprise, I found this domestic science course equipped with the little hot plates with tin boxes set on top, and on the platform was a low oven range. Five hundred young ladies were out there looking at that. They will be wives some day, and they will use gas ranges, especially in this particular city. On buying a gas range they will go back to what they learned in college, and say, "That is what the teacher taught me on; that's good enough for me now." We should get away from the tin box and the little hot plate on a little low work place, when we go into colleges to teach the future wives of this country how to use gas and why they should use it. I will ask the manufacturers to quit making that hot plate and tin box on which to feed the gas man. The average gas company does not sell this to the city. It is advertising, and the best advertising you can do is to get a domestic science course in a college or in a girls' high school. Just because the tin formed hot plate can be given away, the average gas man, wanting to get something as cheap as he can, is making the mistake of his life. [Applause.]

Mr. Dean—Mr. Rushin, I think, started something so far as I am concerned, when he referred to the manufacturer not being willing to say that there were gas men, buyers of gas appliances, who didn't know how the gas appliance was made. Let me relate you a little circumstance that happened to me once. Being requested to send a line of sample ranges for the inspection of a certain buyer, the stoves and ranges came, were set up, and the buyer kept the appointment with me. I went over the entire line, stripped the stoves and showed all the details of the interior construction, and all the time I was do ing this talking, this buyer was looking out of the window. Right in the midst of description of one of the important things, as I thought, he said: "That's a pretty nice bulldog next door; ain't it?" That is rather discouraging to one trying to describe the make up of a range to a large or even small buyer. Discussing this very point with a gas man some time ago I thought I would like to have here to-day at the Southern Gas Association a gas range manufactured by our Company, and ask our President to have placed alongside of it a range of any other make, then offer a prize to any gas man who could write a complete and detailed description of the construction of the range. I don't believe more than a dozen gas men here know how a gas range is made. I was in the business 4 years before I knew how they were made, and have much yet to learn about them, but I believe if some one were to write for a prize a dissertation on the construction and specifications that go to make up a gas range and that paper to be read before the Southern or an other Gas Association, and the representative of the stove so written about were to criticize that description, the proceeding would be very instructive to all gas men, particularly so to the fitters. Mr. Rushin refers to the manufacturer declining to sell hot plates. My remarks are entirely along the lines that I spoke of before; we have to supply the demand. If you demand a cheap gas range, and we can make that cheap gas range so that we can make some money on it, it is a cinch that it will be made. As to hot plates, there is often as much profit for a 2 burner hot plate as there is in 4 burner single oven gas range. I want you to consider that question when you criticize the manufacturer for making cheap goods. We simply make and supply a demand, and what our buyers through the solicitation of other manufacturers, compel us to compete with, It is a case of our making what the trade demands, when it comes to a question of making a better appliance, something that will not rust. The rust question is the most serious of all in the gas range industry. Two years ago a material came out known as aluminum steel, and several manufacturers put goods of this nature on the market. There is a material practically anti-rust. And although it costs $1.50 on a double, 16-inch range, $1.75 for a double 18-inch range, and $2 for a cabinet range, not over ½ dozen gas companies in Dixie are now selling anti-rust ranges. Here it is a matter of $2 at most on a cabinet range, yet with that material you can practically overcome all of the rust troubles of the coast towns, as has been proved by those who have sold them for the past 2 years.

Mr. Pierce—This question of coming electric competition is one that is of particularly timely interest, and in discussing this question we are dealing with a condition, not a theory. That sort of competition is here now. At the Williamsport meeting of the Pennsylvania Gas Association, Mr. Bigelow stated that the gas and electric folks at Rochester, N. Y., had purchased 1,000 electric ranges which were to be put out on a flat rate of $5 per month. Now, it is true that, at $5 a month, an electric range cannot compete on an absolute basis of cost with a gas range; but it is not necessary for electricity to compete with gas upon an equal basis of cost. For instance, the light produced by the tungsten lamp, costs, with 10 cent electricity, about 3 times as much as the same unit of light produced with gas at $1 per 1,000, but some of the people seem quite willing to pay the three times. In the incandescent carbon filament lamp (has ;just passed up in the last year or two) light cost 9 to 10 times as much as gas light, but the electrical man had so thoroughly imbued his customers with the idea that the use of gas was harmful, vitiating, inconvenient and dirty, that his customers were perfectly willing to pay 4 or 5 or 8 or 10 times as much for a certain service by electricity as they would be willing to pay for gas. If such condition exists in the consumers' minds, there is no reason in the world why the customer should not be willing to pay 3 or 4 times as much for electric service cooking as for gas fuel. It is purely a question of what the customer thinks about it. If he is convinced that gas befouls the air with dirt, that it is dangerous, with all that sort of thing, he will give electricity the preference, a preference that may go to the extent that he is willing to pay 4 or 5 times as much for it. We cannot successfully dispute the fact that electric ranges, put out on a basis of $5 a month, would, for certain classes of service, give us pretty stiff composition. It is worth investigating why it is that electricity can be made to compete with gas even to that extent. There are in a kilowatt of $1 electricity, about 3,500 B. T. U.'s. Taking gas of 600 calorific value, gas would be equal to electricity at .4 of a cent per kilowatt—that is, compared by thermal units produced; but it is possible to use electricity with much greater efficiency than gas, as with the former all of the heat can be localized and confined right where it is being used. The gas products, however, must be taken care of, and must leave the zone of combustion at a temperature not less than the temperature which you require for your operation. Therefore, as there is an unavoidable loss for the amount of heat required to raise those gases to that point, it is impossible to utilize gas as efficiently in that respect as electricity. Most of the authorities agree that the efficiency——

Mr. Schall—I would like to ask Mr. Pierce how he makes up for the electricity that is lost in the current as applied to domestic heating appliances?

Mr. Pierce—There is a certain loss. I do not claim that electricity has an efficiency of 100 per cent. but it has much closer to 100 per cent. than can be obtained by the use of gas. We have these unavoidable losses in addition to the radiation losses, which we have both with electricity and gas.

Mr. Schall—Does not the lagging make up for the difference lost by the products of combustion?

Mr. Pierce—That would depend to a great extent upon the construction of appliance to the temperature at which it is operated. I have seen tests giving an efficiency of as high as 90 per cent., with certain types of instantaneous water heaters, which are about the most efficient gas burning appliance we have. That is on account of the fact that the temperature is a comparatively low one, but where a higher temperature must be secured the heat losses are correspondingly increased. The only way to determine this in a particular apparatus is to conduct an efficiency test of the two types of apparatus side-by-side and determine which has the greater thermal efficiency—the ratio of heat units going into substance to be heated and the heat units drawn from gas or supplied by electricity. I am quite certain, however, that with an appliance for any given service, a greater proportion of the heat units will be utilized in a well designed electric apparatus than in a well designed gas apparatus, because there are certain unavoidable losses in the gas appliance that one does not have to contend with in an electric appliance. Even that isn't anywhere near sufficient to enable the electric man to compete with gas for cooking on an equal cost basis. Assuming that the efficiency of gas burning appliances is, say 65 per cent. of an electrical appliance, which is quite liberal. On that basis the electric supply company would have to sell electricity for .6 of a cent per kilowatt hour to compete with gas at $1 per 1,000. Undoubtedly electricity at 8 or 10 cents can never widely compete with gas for heating and cooking, but the nub of the matter is here. I advanced this line of argument at the Denver Convention and few agreed with me, but I also advanced it at the Pennsylvania Convention and had the satisfaction of being commended and supported by all combination men who were there; at least, they endorsed the accuracy of the remarks. Electricity being a product which cannot be stored, requires for its efficient production a uniform load. In a gas plant we can store the gas, the foot of gas made at noon costing no more than the foot made at 6 o'clock, and vice-versa. In the load of electricity, however, it costs a great deal more to produce current at 6 P. M. than it does at 3 P. M. or 9 A. M. If a certain central station plant had its maximum capacity demand at 6 o'clock—so it generally goes, between 5 and 7, ranging in different seasons of the year and in various locations—has a maximum demand of fully 80,000 kilowatts capacity in machinery must be installed to supply that demand. In most cases there will not be over ¼ the capacity which will be used during the remaining 20 or 21 hours of the day. Electric rates are made in nearly all cases, so that the light customers pay the entire fixed charges on the plant and distribution, which means that the electric company can produce electricity during the offpeak period, when the machinery would otherwise be idle, for the mere cost of coal under the boilers—in a large plant, not over ¼ cent per kilowatt, plus labor. The item of labor is not greatly increased by operating that portion of the plant at ¼ its capacity as against ¼, but the item of labor enters into it. Therefore, where the electric central station has a large

lighting load, great inducement is offered them to go after offpeak business, and they can make extremely low rates to get it. In some places in this country that has come about. It is coming about quite generally in England. In London, rates for lighting current run from 10 to 14 cents, but for cooking to the same customers, they can afford to sell it for 2 cents. They make more profit on their 2-cent current for cooking than on their lighting current for 10 to 12 cents per kilowatt; that is (considering the way they keep their books), they make lighting carry the entire fixed charges on the plant. The greater the lighting business, the more imperative it is to get heating, fuel and industrial business, and the cheaper they can make current for such consumers. I won't say it is the only way, but the essential step that should be taken to forstall competition in heating and cooking, is to hold on to the gas lighting business, because the lighting customers put electric men in a position to compete on heating, fuel and industrial appliances. If the electrician has an absolutely uniform load a unit generated one part of the day would cost just as much as at another part, and he would not be able to sell electricity for any purpose at such a low rate as he can now sell it by reason of the peak load which he has, and the large amount of machinery lying idle which will produce electricity for the mere cost, as I said before, of coal under the boilers, plus labor.

Mr. Schall—We are all interested in this electric subject as compared with gas, so perhaps Mr. Pierce may have instilled some wrong impressions. I have given this subject considerable study for some 10 years, and think what he said, although correct, yet, in the same ratio, it is wrong, and for this reason. An electrically constructed appliance to-day is not properly constructed. It does not give the service that a gas stove does; neither can it ever give the same service under its present construction as compared with gas. I am speaking advisedly on the subject. As to temperatures of fuel gases which escape from the modern gas appliances, that has no effect whatever, in comparison with electricity. I disagree with Mr. Pierce on that subject, having made some very careful practical tests regardless of theory. In making my comparisons regarding the thermal heat units in a ton of coal, as these exist to-day, he has not mentioned that fact. He speaks of the overhead charges. Have you thought of the by-products of your gas? There is another element you want to consider. Still another thing. To day the construction of your electric appliance is one only lasting a very short time, because it is hermetically sealed—the application of the heat is wrong. I do not think it is necessary to go any further. You will all agree that you cannot—until you reach what you have accomplished to-day in the storing of gas—ever accomplish by storing of electricity what you have in your business Your load is set where it was in electricity. Regarding the line of least resistance, I would like to say a few words. He is right. There is no element of salesmanship that enters into any contract where the sale of an appliance to a consumer is below cost. It must be sold at a profit to your corporation; otherwise, there is no element of salesmanship in it. Your consumer knows it, you know it, and the State Commission recognizes it. They will not consider a charge against the price of a cubic foot of gas against your appliance department. It must pay for itself; it must sustain itself. Therefore, the appliance should be sold, as I said before. An appliance must not be auxiliary in its character, but permanent, and a permanent appliance means something that will replace all other business, all other appliances.

Mr. Andrews—I am what one might correctly term a freshmen of the organization, but I represent a section of the Southern Gas Association that is as rich in promise as any other section, so I am going to assume somewhat in representing Piedmont, N. C., this afternoon, my remarks will not be given to you with the idea that they represent mature judgment or infinite wisdom. No, only that I simply represent, like the rest of you, a fellow trying to get dope; one of these trying to get the best method to further the sale of gas. I have listened with much interest to Mr. Case's paper; also, to the discussion. A gentleman remarked that, in a great many cases, or in a particular case, he found the attitude of the purchasing agent was wrong; and I agree with him. I saw a parallel case. The purchasing agent can assume the attitude, that "We don't care about quality; what we want is price." I agree with Mr. Case's paper, that very often a man can be a "bone head" in taking that attitude. It seems there are two sides to this. An old friend of mine once said, it depends on which side of the fence you stand, whether you are outside pecking to get in, or on the inside pecking to get out. The central station man the gas manufacturer and the appliance man have problems to solve. I think the duty of the appliance man is this. The manufacturer, that he takes the attitude of the eminent James J. Hill of assuming the braodest policy in building up your concern. He will not tell you that it was because of philanthropy that he fostered immigration into the great Northwest, but he will tell you that it was his faith in that policy. I think the attitude of the manufacturer should be that, "we are to make the best range possible." It may be you will have to make cheaper appliances and cheaper ranges and continue making hot plates. Well, make them, because you know I am in the gas business to sell gas, not appliances. I want to sell gas, and the only reason that I am interested in your appliances is that they consume gas, here the problem is quite different; but I do think that the gas fraternity should assume a fair attitude and realize that at times they have put price before quality. Our experience in Piedmont, N. C., has been somewhat similar to yours. We began by thinking that the public would only use one class or type of appliance, but when we put a better one on the market they used it. However, that doesn't say that everybody on your lines wants to, or will use or can use the best appliance made. In our section the panic hit us pretty hard. Lots of our folks should use more expensive appliances; but they don't have to. And what are you to do? Say, use this up-to-date modern appliance against the hot plate with the end of absolutely turning them against the use of it at all? What we want is to sell gas (that is the way I look at it) and we don't want to forget what our attitude is towards the results we strive for and, with all due respect to the appliance man, what they are after. An idea that has occurred to me is that we might change this subject from better domestic appliances to better care of domestic appliances. We have papers on maintenance and the following up of complaints with care exercised toward consumers, etc. But we are confronted in the South with the problem of negro help, and very often the lady of the household is not familiar with the conditions in her kitchen. It seems just as vital that the members of the Southern Gas Association educated the women members of their household to the best care of their appliances, as it is that they emphasize to the manufacturers the best development of gas appliances. For instance, why should we talk about developing a range that would last 15 years against 7 years. I use these basis merely as a comparison, when probably there are ranges on our lines lasting only 50 per cent. as long as they should. My point simply is that, in the business department or whatever department will effect it, let us help educate those in the kitchen, those buying their appliances, to the end that in taking the best care of the appliances they get the best use out of them.

Mr. Congdon—This information may be of no interest to the gas stove manufacturer, but my next door neighbor. a very successful salesman for the General Electric Company, made such a record in the South that he was recently promoted and taken into the Northern offices. His new work is to entirely look altogether after the manufacture and introduction of the electric stove. I don't know any more than that, except that the General Electric Company have a very high cost for foreign buyers, and I know they have employed two or three gas men to help them along in the fight.

Mr. Pierce—I dislike to pursue a purely academic discussion. The points that Mr. Schall brought up, are points that have a bearing to satisfy all of us by actual tests. All the tests that I have seen (in German, French, English and American periodicals) of reports of tests on heating apparatus indicate an average efficiency of about 50 per cent. greater in the case of electric over gas burning appliances, as they are constructed. Regarding the durability of electric appliances, they are manufactured so that the heating unit will be easily replaceable at a comparatively small cost. I spent about 3 years in the manufacture and design of electric heating appliances, and know something of what I speak. I am holding no brief for electricity. No other man in this Association, nor in the National Commercial Gas Association, believes in putting up a stronger fight for gas all the time than I do, and the point I am making is, as long as the electric man goes out with his slogan all the time "for everything electric," he will stand a better chance of getting it all than the man who simply goes out and says "Cook with gas." That is my argument. We want to fight for gas for everything, and not fool ourselves into the belief that there is no possibility of competition. We are having that competition. When we begin to think there is no competition, that's the time we are going to get it. What I am making my entire fight on is, that our slogan should be gas for every purpose under the sun for which it can be used, and fight for every 5 cents' worth of business that can be obtained through its use. Quite recently there was published in the *Gas World*, of London, an account of an experiment by a disinterested German investigator, as to cooking by gas and cooking by electricity. I say disinterested—he was neither a gas man nor an electric man. He found the efficiency of the electric apparatus was 70 per cent.; of gas, 50 per cent.; but even then, the results were very favorable for gas. Remember, our electric friends are not going to remain satisfied with 70 per cent., and we must not remain satisfied with 50 per cent., or anything like it. However, I am rather encouraged when I see the accounts of a gas-fired boiler developing 95 per cent., and of 1,196 pounds of lead being melted by 100 feet of gas. The whole thing is up to the manufacturer. He must supply us with appliances of greater efficiency, and I am very much pleased to hear from Mr. Schall that investigations are being made on that subject: that we are not going to continue in the old rut. I hope Germany will be the occasion of the latest developments in giving us the most efficient appliances that can be brought out.

The President—We will have to close the general discussion. I would like to give 5 minutes in which any representative of any appliance company may speak, particularly, the range companies. Will Mr. Rand, of Anniston, Ala., who represents a combination company, and who is especially well-versed in electric matters, tell us something about electric stoves?

Mr. Rand—We have not many electric stoves in Anniston, but the holding company, by whom I am employed in the Far West, in one city last year put out 187 electric stoves, and we will get the benefit of the data which they have been able to get on the operation of those stoves. Their data shows the average family of 5 people can do its entire cooking on an electric stove, paying 4 cents a kilowatt for power, for a fraction under $5 a month. I do not think the gas people need worry about the electric stoves of our people that operate combination plants. I put out two electric stoves last week for people who wanted a ridiculously long extension of our gas main for one customer. I can get away from those long extensions with an electric stove, but it is a little different if you operate gas alone. A year from now, to my positive knowledge, there will be an electric stove put on the market that far exceeds anything that ever has been put on the market as a cooking stove, electrically. The General

Electric Company is making it, and is taking orders to furnish them 1 year from now. It far excels anything ever made in the way of cooking stoves. The electric cooker is going to be a good thing for suburbs where you don't want to extend your mains, and used in connection with combination plants. I believe it is going to be a blessing in disguise.

The President—Mr. Case do you want to close?

Mr. Case—Just a moment. There seems some apprehension as to the meaning I intended to convey in my paper. When I said, "Sell better gas appliances," I didn't mean that you were going to compel every customer to buy a $50 range, but wanted to induce you to give the customer who will buy it an opportunity to do so, if he has a desire. There are in my mind two instances very marked in this respect. One company in one of the best known and largest cities in the South, that during my calling there for the past 3 years has never exhibited a stove costing over $30 on its floor. The people being cheap demanded cheap goods. As to still another company in the South. Its manager told me not over 2 months ago, "I don't sell 1 low type range in 10, and the majority of my sales are of $40 to $50 ranges." If that can be done in a town of 8, 10 or 12 thousand, what could be done in a town from 50 to 100,000? Give the people a chance to buy it. Put a high priced range on the floor. If some one buys it, put another one in its place. Give them the opportunity to buy it if they have a desire.

At this point Mr. Bowlin read a communication from Mr. J. S. Howsman (New Orleans) entitled, "Discussion on Paper, 'Better Domestic Appliances,'" as follows: I am deeply appreciative of an opportunity to say a word following Mr. Case's able paper; but I wish, first, to express my sincere regrets, to you and the assembled members of the S. G. A., in not being with you in person, and were it not for the base insinuation, might jokingly add that I am with you in "spirits." However, to the subject at hand. I wish to take a fearless stand with Mr. Case and any and all other appliance men, who say, "Raise the standard of appliances," and then back up the statement by positive and determined effort to do so, even at the risk of losing some orders and, therefore, certain prestige, rather than compete on the "Price Basis." This same thing, the "Price Basis," is the ultimate consumer's greatest enemy. He is the man who suffers. Therefore, "palming off" on him (and it simply comes to that) such inferior material, at the same time that I am preaching education and growing hoarse from throaty efforts to force the dear public to realize that I am their friend, is not only cheap trickery, but is a boomerang which strikes at the vitals of the business. You must have the confidence of your public. Show me a gas company in whom the public has no confidence, and I will show you a gas company under developed in every department of its work. A concrete illustration of past endeavors could not be more forcibly drawn than that by Mr. Case in paragraph 1, page 4, under the subhead, "Sell Better Cooking Appliances." We've all come in contact with his smiling insinuations along this line, but when you see it in print, it certainly "sticks out," and I, for one, am going to "take it home." I'm not pleading guilty to a past lack of interest in this sort of development; but I'm like the "revived" sister at "Experience Meetings." I'm going to press onward and upward.

(To be Continued.

Recent Patent Issues.

Prepared for the American Gas Light Journal by Royal E. Burnham, solicitor of patents and counselor in patent causes, 833 Bond Building, Washington, D. C., from whom illustrations and specifications of any patent mentioned below may be obtained for 20 cents.

1,026,666. Gas or Smoke Washer. O. M. Foster, Elkhart, Ind., assignor, by mesne assignments, of one-fifth to S. K. Dickerson, one-fifth to D. R. McBain, one-fifth to D. C. Moore, Cleveland, O., and one-fifth to C. E. Schaff, Chicago, Ills.

1,026,814. Gas Furnace. A. K. Lindley, Los Angeles, Cal., assignor of one half to M. E. Sharp, same place.

1,026,848. Electric Lighter for Gas Burners. S. Brown Chicago, Ills.

1,027,154. Gas Generating Furnace. G. Richter, Stettin, Germany, assignor to Ofenbau-Gesellschaft. M.B.H., Munich, Germany.

1,027,290. Method of Making Producer Gas. H. H. F. Smith, Lexington, O.

1,027,449. Cylinder or Globe for Inverted Incandescent Gas Burners. A. P. Storrs, Owego, N.Y., assignor to Storrs Mica Company, same place.

1,027,519. Gas-Controlling Mechanism for Gas Burners. E. O. Bentley, Baltimore, Md.

1,027,534. Safety Device for Gas Burners. L. W. G. Flynt, Rochester, N. Y., assignor to Domestic Appliances Company, same place.

1,027,631. Manufacture of Gas. W. H. Williams, East Liverpool, O.

1,027,743. Gas Light Fixture. S. Maas, Kalamazoo, Mich., assignor to American Gas Light Company, same place.

1,027,862. Apparatus for the Separation of Hydrogen from a Gaseous Mixture. C. von Linde, Munich, Germany.

1,027,863. Apparatus for the Separation of Hydrogen. C. von Linde, Munich, Germany.

1,027,934. Needle Valves for Gas Burners. A. G. Thomas, Pittsburgh, Pa.

Items of Interest
FROM VARIOUS LOCALITIES.

Mr. Walter S. Tobey, former draughtman for the Pulaski Heights (Ark.) Gas Company, has resigned from that service to accept the position of Sales' Manager for the "Record Publishing Company," of St. Augustine, Fla.

The proprietors of the proposed Billings (Mont.) Gas Company have secured the services of Mr. E. G. Pratt, of Chicago, to act as Consulting Engineer for the construction of its new gas plant. A site has been purchased, and the work of main laying is now under way. Mr. W. B. Snyder will have charge of the construction work in Billings, and the contract on account of apparatus has been mainly awarded to the Gas Machinery Company, of Cleveland, O.; at least it would seem so from the fact that the Cleveland folks have been authorized to furnish the water gas apparatus tar extractor, purifiers, meters, oil tank, boilers, connections, etc. Mr. Snyder's contract for building construction is well underway, and it is confidently asserted that the residents of Billings will have gas by September 15th.

Messrs. Henry L. Doherty & Co., 60 Wall street, N. Y., are offering an issue of City and County bonds, Denver, Col., amounting to $1,685,000, at par. The bonds bear 5½ per cent. interest, payable annually, April 1st of each year. They are known as East Denver, Park District, are dated April 1, 1912, and are redeemable April 1, 1927. They are subject to call any time, on 30 days' notice, *in numerical* order, at par and accrued interest.

The stock of the American Gas and Electric Company is now on a 7 per cent. basis, the last quarterly dividend having been moved up to 1¾ yer cent., instead of 1½ as heretofore.

The annual meeting of that sterling old corporation, the Pawtucket (R. I.) Gas Company, was held in its main offices some days ago. The retiring Board of Directors was re-elected in the persons of Messrs. F. W. Easton, F. P. Royce, S. A. Jencks, Jno. A. Arnold, A. M. Coats, S. Buttrick, K. Wood, Howard W. Fitz, Russell Robb, F. B. Bemis and F. S. Pratt. The Directors in turn renamed the following executive management: President, Frederick W. Easton; Secretary, C. W. Crawford; Treasurer, George A. Stiness; General Manager, William McGregor more power to his clever self.

Manager O. W. Halladay, of the Marlboro-Hudson (Mass.) Gas Company, having talked it over with the men, that, by working an extra half hour during the other week days, they can leave their stations at noon of each Saturday. This plan will prevail up to the last Saturday (31st) of August.

Writing of Mr. Halladay and his men recalls the fact that his and their experience last winter with frost and ice in Marlboro was of the most strenuous type. The seal to one of the gasholders (iron tank resting place) froze solidly and the holder, of course, was out-of-commission. Mr. Halladay found that, when the "thawing" process was completed, the tank would be well out of commission. It is true that considerable damage was done to both container and retainer; but patience, without any excessive resort to executive ability measures, so carried out the task that the holder and tank are now doing their work without a hitch.

Mr. Jno. T. Bayless, one of the oldest employees of the Consolidated Gas and Electric Company, and one of the first to enjoy the benefits of the pension fund organized by that great Baltimore corporation last March, died at his home in that city some days ago. He was in his 71st year, and had been in the employ of the Consolidated and its predecessors for 42 years.

Mr. Patterson T. Caldwell, for some years Township Treasurer, Youngstown, O., and for 46 years a resident of Youngstown, died at the home of his daughter, 56 Thornton avenue, Youngstown, the afternoon of Sunday, the 10th inst. Forty years ago (deceased was born in Mount Jackson, Pa., November 19th, 1826) Mr. Caldwell was Superintendent of the Youngstown public school systems, but resigned this trust (1884) to enter the executive service (as Secretary) of the Youngstown Gas Company. He continued in that service for 15 years, and was then elected Township Treasurer, which place he filled acceptably for two terms. This marked the end of his business career. He is survived by two children, Mrs. N. S. Abrams, of Youngstown, and Mr. A. B. Caldwell, of Washington, D. C.

BIG BODIED, large-hearted "Ed." F. Gallagher, has been authorized by the proprietors of the Ionia (Mich.) Gas Company ('tis more than likely that he convinced the proprietors of the sensibleness of the "move"), to make public the fact that, beginning August 1st, the selling rates in Ionia shall be:

Quantity, per Month.	Gross.	Net.
Less than 400 cubic feet..... ..	$.50	$.46
500 to 5,000 " "	1.25	1.15
5,000 to 10,000 " "	1.15	1.05
10,000 to 50,000 " "	1.05	.95

Special rates will apply on all consumption in excess of 50,000 cubic feet per month. The only requirement to obtain the net rate is payment of bills within 20 days from the time of rendering. This is the 7th voluntary reduction made by the Company since 1882, when the figure was $2.50 per 1,000. That the "big man" must have very persuasive ways about him would seem shown when it is known that the Company has 1,136 consumers on a distribution system embracing perhaps not to exceed 12.32 miles of mains.

MR. CLARENCE P. SAWYER, formerly Superintendent of the Westbrook (Me.) Gas Company, has joined the forces of the Stone & Webster Company, of Boston. His headquarters for the present will be in Pawtucket, R. I.

SATISFACTORY terms have been arranged under which the Salem (Mass.) Gas Light Company will place its new office building in Essex street, directly east of the new building of the Merchants' Bank, in line with the latter. The Gas Company's structure will be Colonial in style, and it is thought it will be ready for occupancy early next year.

"B. W. T.," writing from Los Angeles, Cal., under recent date, forwards this: "An odd legal proceeding is that recently instituted in this city by Mr. W. J. McGimpsey, who, with the object of having determined the legal President of the West Coast Gas Light and Fuel Company, a corporation that supplies the suburb of Huntington Park with gas, brought suit to enjoin Mr. R. E. L. Sackett from acting in that capacity. The suit was brought in the Superior Court. In the complaint McGimpsey alleges he was elected President of the Company, October 23, 1911, and continued in such capacity until April 25 last, when, he declares, a meeting of the Directors was called without his knowledge, and Sackett was declared President. Presiding Judge Willis issued a temporary restraining order as asked, together with a injunction to Sackett to show cause why the restraining order should not be made permanent."

A CORRESPONDENT in Ottumwa, Ia., forwards the following from that city under date of the 18th inst.: The proprietors of the Ottumwa Gas Company recently issued a notice of substantial reduction in the selling rate, the same to become effective the first prox. The fact that the Company reduces its selling rate at a time when it is engaged in the expenditure of a large amount of money on its manufacturing and distributing systems well proves the belief of its proprietors for the continued growth of their bustling city. In fact, it is to keep up with the expansion of Ottumwa, and the resulting universal use of gas, that the Company is going to this expenditure. A contract has been entered into with the Keefe Brothers, local men, to rebuild and enlarge the structures at the works. The construction will be of brick, cement and steel, all to be absolutely fireproof. Contracts have also been closed with the Kerr-Murray Mfg. Co., of Fort Wayne; the Lloyd Construction Company, of Detroit; and Chas. H. Dickey Company, of Baltimore, for additional apparatus and machinery. The Company has laid a new 8-inch main in Court, Third and Fifth streets, with a view to remedying the lack of supply in the districts north of the river and west of Vine street. Pipe has been ordered for a new main of ample diameter to be laid from the gas works across the Vine street bridge to improve the service on the south side of the river. When these improvements have been completed Ottumwa will have one of the most modern plants in the State."

MR. JAMES GREEN, Assistant Superintendent of the Utica (N. Y.) Gas and Electric Company, died at his home in Utica, the morning of the 18th inst. He was born in Mechanicsville, N. Y., the 21st July, 1874, and for the past 11 years he has been with the above-named Company. He is survived by his wife and two daughters.

MR. THOMAS F. HOLDEN, for 25 years or more in the service of the Washington (D. C.) Gas Light Company, and one of the cleverest contracting and operating gas engineers in this or any other country, recently inspected the plant of the Blaugas Company, of America, which is eligibly located in Long Island City, Borough of Queens, L. I., with a view to advising the proprietors as to how certain stoppages in the system could be overcome. Mr. Holden is ready to accept an engagement with any American Gas or Gas and Electric Company that desires to engage a competent works' engineer or constructor. Mr. Holden's connection made him *non persona grata* with the Leiter combination in Washington.

THE reconstruction of the plant of the Oshkosh (Wis.) Gas Light Company includes the building of a gasholder up to retaining 500,000 cubic feet.

IN the renewing of the plants of the Chatham (Canada) Gas Company, the plans call for the placing of a 1,500-horse power gas engine, which will be used as the main motor power in the Company's electrical division.

"B. B. T.," writing from Topeka, Kas., under date of the 15th inst., says: "Last week the final example in the damage suits instituted against the local Gas Company and the authorities, in respect of what are known here as the 'Seventh street fire cistern explosions' (1909), was settled last week when Jacob A. Dice accepted the sum of $1,000 in full payment for injuries sustained; the Company and the city sharing equally in the satisfaction of the judgment. The last week in May, 4 of the 5 cases pending in this instance were compromised, while a sixth case had been disposed of in the courts. After the explosion the city paid all hospital and doctor's expenses or charges in connection with the case. He had been a street laborer for several years, and when he was able to return to work he was promoted to a foremanship; and it is said that it was this considerate and kind treatment of Dice by the defendants that largely affected the settlement."

THE New Jersey Gas and Electric Company has been chartered in Wilmington, Del., by Messrs. Isaac Fogg and George D. Hopkins, both of Delaware. The Delaware Charter and Guarantee Company (capitalized in $1,000,000) has also been incorporated, and it is in some sense a dependent of the first named concern.

THE proprietors of the Ashland (Pa.) Gas Company have reduced the gross rate on gas sold for fuel purposes on all accounts to $1.50 per 1,000, less 10 per cent. for prompt (within 10 days) payment.

THE Quincy (Ills.) Gas, Electric and Heating Company has just concluded a series of demonstration lectures on the use of gas for all purposes; but particularly in respect of its use in the kitchen. The sessions were held in the Bijou theater, and the lecturer was Prof. C. E. Draper.

"B. V. T.," writing from Snohomish, Wash., says that Mr. John S. Burton, who retired from the local management of the Everett Gas Company's gas and electric system in Snohomish about a month ago, and who has since been appointed a member of the City Council, has accepted the position of constructing engineer for an electric light and power system, including water power development, for Sultan City, Wash. The owners of the proposed system are I. C. Anderson, Frank Friese and Herman Friese. The Messrs Friese are prominent in the grain trading of Snohomish.

THE Massachusetts Lighting Companies reports show net sales of gas and electricity for last May, amounting to $66,900 as against $62,974 for the corresponding month in 1911. The net sales for the 11 months ended May 31, are $831,514, as against $779,233 for the prior 11 months in 1911-10.

HERE is a pretty good object lesson, for the facts in connection with which we are indebted to the courtesy of Mr. M. H. Spear, Secretary and Manager of the New York and Queens Gas Company, Flushing, N. Y.: A prepayment collector entered by mistake a store from whence a prepayment meter had been removed. Going to the back of the shop it was discovered that the service pipe and house-riser had been connected with a hose. Behind the door leading from the shop into a sort of living apartment, he found a 2-hole hot plate briskly simmering in a gas flame. The proprietor of the place (an Italian) immediately cut the hose and threatened to eject the collector. The latter, though, was of the husky sort, and did what he should have done. The fellow was arrested, and was held in the Police Court for Special Sessions. Later on (the 18th inst.) that tribunal disposed of the case. He was found guilty and a fine of $100 was imposed. Penalties of this nature are those that likely will put a stop to thieving of this sort.

The Market for Gas Securities.

No change worth noting is reported in values for Consolidated gas during the week. In fact the only change is ¼ up in the bid price reported this morning (Friday), which is: 141¼ to 143. The regular midsummer dull spell is surely on.

Brooklyn Union is 141 to 143, but the quotations are strictly nominal, being to day (at the start) 141¼ to 143. In out-of-town shares no altering of values is reported, although Lacledes are up a point. The reassuring thing, though, in the situation is the number of Companies at present in the market for figures on additions and changes to plants; also, the activity shown in charter applications for centers the populations of which have reached the point where gas plants must be constructed, if the needs of such residents are to receive any consideration. We have record so far this year (up to June 8th) of 30 new gas works propositions. U. G. I. is showing pronounced strength, sales having been made in it yesterday at 180 Likely before long there will be a capital readjustment in this corporation.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY

JUNE 24.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$78,177,000	100	141½	142
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	103	105
Equitable Gas Light Co.—				
Con. 5's, due 1932, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	3,500,000	100	165	175
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102½
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98¼	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	100	109
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	141½	143
1st Con. 5's, due 1948, M. & N.	15,000,000	—	106¾	107
Yonkers	299,650	500	180	—
Out-of-Town Companies.				
Bay State	50,000,000	50	⅛	⅝
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	35
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,000,000	1,000	104	106¼
Cincinnati Gas and Electric				
Co.	29,500,000	100	87	90
Columbus (O.) Gas Co., 1st				
Mortgage Bonds	1,500,000	1,000	96	98
Columbus (O.) Gas Lt. &				
Heating Co.	1,682,750	100	90¼	91
Preferred	3,036,500	100	75¼	80
Consumers, Toronto	2,000,000	50	200	204
Consolidated, Baltimore	13,460,084	—		—
Mortgages, 5's	3,400,000	—		—
General Mortgage 4½	10,661,000	—		—
Con. Gas Co., Baltimore				
City, 4½	2,751,000	—		—
Consolidated Gas Co. of N. J.	1,000,000	100	15	—
Con. Mtg. 5's	976,000	1,000	94	96
Bonds	75,000	—	—	100
Detroit City Gas Co.	6,580,000	—	—	50
Detroit Gas Co., 5's	881,000	1,000	75	80
" Prior Lien 5's	5,619,000	1,000	97	100¼
Equitable Gas & Fuel Co.,				
Chicago, Bonds	2,000,000	1,000	—	101
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	-
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	130	133
" Bonds, 5's	10,500,000	—	101	106
Indianapolis	2,000,000	—	—	88
" Bonds, 5's	2,650,000	—	104¼	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	200,000	1,000	91	95
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	99	102
Laclede Gas Co., St. Louis.	10,000,000	100	106	106½
Preferred	2,500,006	100	114	120
Bonds	10,000,000	1,000	102¾	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	143	145
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	108¾
Massachusetts Gas Compan-				
ies, of Boston	25,000,000	100	90¾	91
Preferred	25,000,000	100	95	95½
Montreal Gas Co., Canada	2,000,000	100	208	210
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	182	190
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	114	114½
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
Pacific Gas and Electric Co.	15,500,000	—	64½	65½
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	106
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,800,000	200	430	435
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 16 to 18, 1912. Marlborough-Blenheim Hotel, Atlantic City, N. J. Officers: President, Ira C. Copley, Aurora, Ills. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting and Gas Show, Toronto, Aug 26th to Sept. 7, 1912. Officers President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 1912. Officers: President, R. M. Searle, Rochester, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street. New York City.

Gas Meters.—Monthly meetings. Chairman, Will W. Barnes; Commissioners, W. H. Pettes, I. W. Peffly: Secretary, H. Thurston Owens, 42 Pine street, New York City.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 19th and 20th, 1913. Chicago. Ills. Officers: President. H. O. Channon, Quincy, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting, Niagara Falls, Canada, Sept. 16-19, 1912, Meetings of Sections, monthly. Pres't, V. R. Lansingh, New York City; Secretary, Preston S Millar, 29 W. 39th street, N.Y. City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March, 1913, Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, Burlington, Ia., May, 1913; Officers: President, C. W. Fair, Atlantic, Ia.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October 17-19. Manhattan, Kas. Officers: President, B. F. Eyer, Manhattan, Kas.; Secretary and Treasurer, J. D. Nicholson, Newton, Kas.

Michigan Gas Association—Annual meeting, September 4-6, 1912; Toronto, Canada. Officers: President, F. W. Blowers, Kalamazoo, Mich; Secretary-Treasurer, Glenn B. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1913; Joplin, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting and Gas Show, Dec. 2-5, 1912, Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, Cleveland, O., May, 1913; Officers: President, M. B. Daly, Cleveland, O; Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February, ——— 1913. Boston. Officers: President, D. D. Barnum, Worcester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Summer Meeting. August 24, Atlantic City, N. J.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn Belmar, N. J.

Ohio Gas Association.—Annual meeting, February ———, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, May, 1913. President, Noel R. Gascho, Alva, Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Diego, Cal., September 17, 18, 19, 1912. Officers: President, W. Baurhyte, Los Angeles, Cal.; Vice-President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, John A. Britton, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, York, Pa., April, 1913; Officers, President, H. H. Ganser, Norristown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 13, 1912; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, April ——— 1913, Charlotte, N. C. Officers: President, C. E. White, Montgomery, Ala.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. April ——— 1913, Galveston, Tex. Officers: President, F. M. Lege, Jr., Galveston, Tex.; Secretary, H. S. Cooper, Galveston, Tex.

Wisconsin Gas Association.—Annual meeting, May ——— 1913, Milwaukee, Wis. Officers: President, I. F. Wortendyke, Janesville, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.

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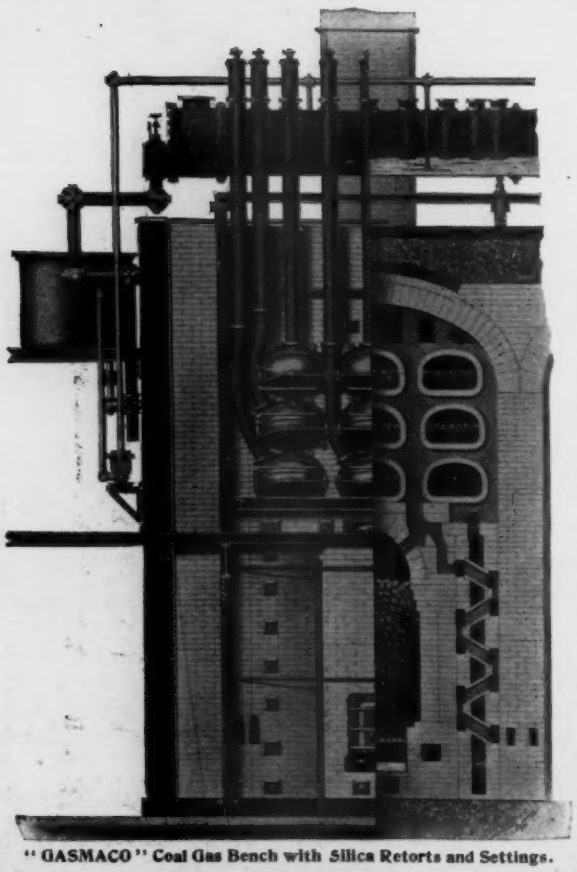

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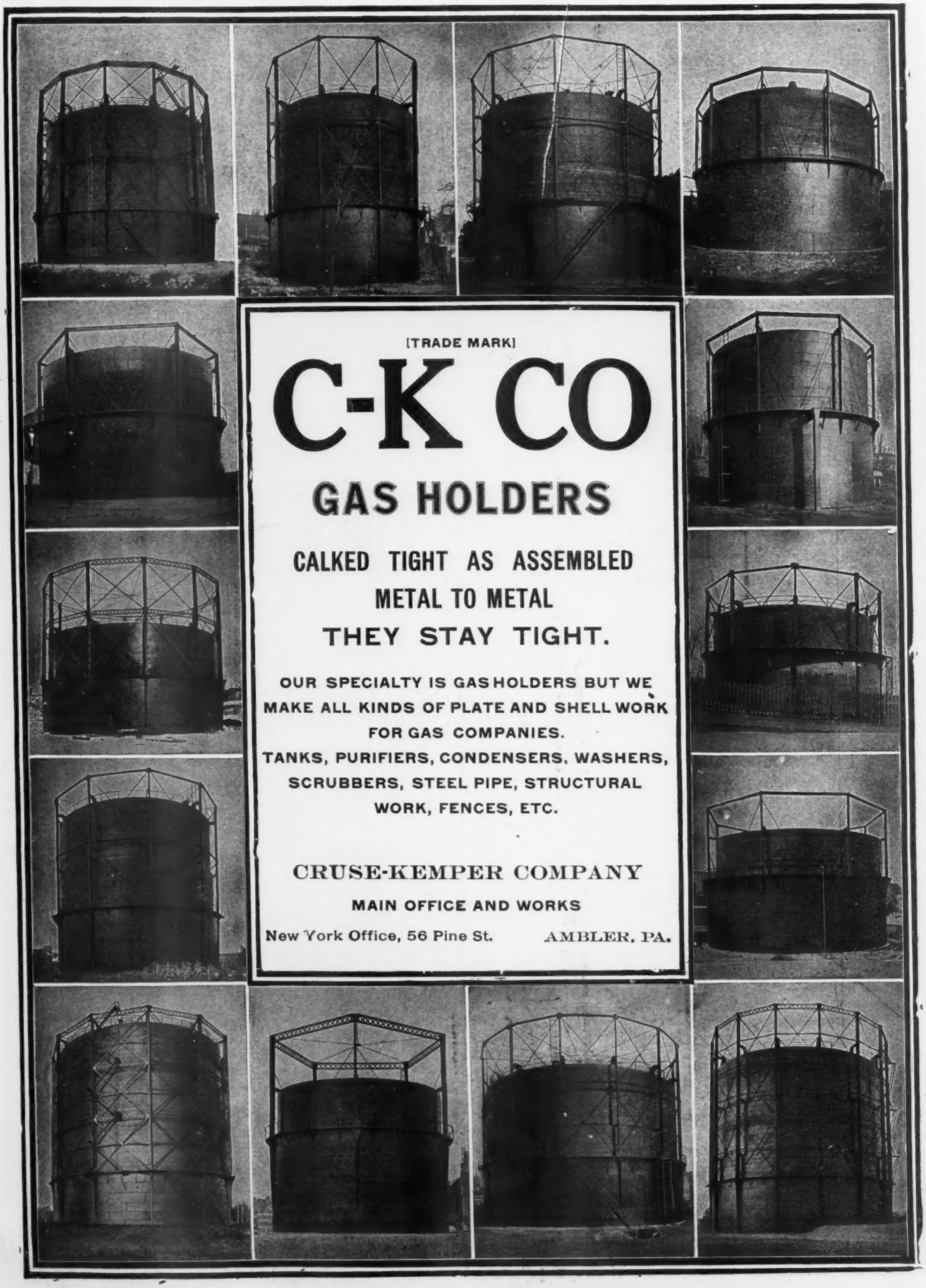

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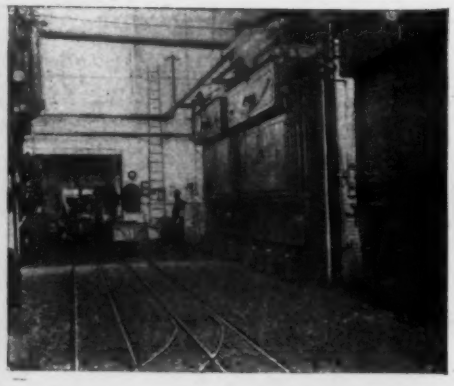

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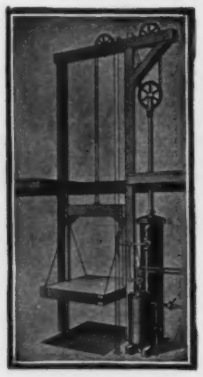

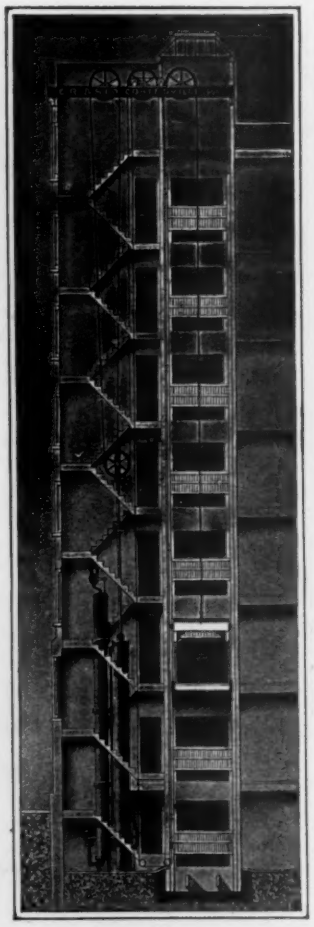

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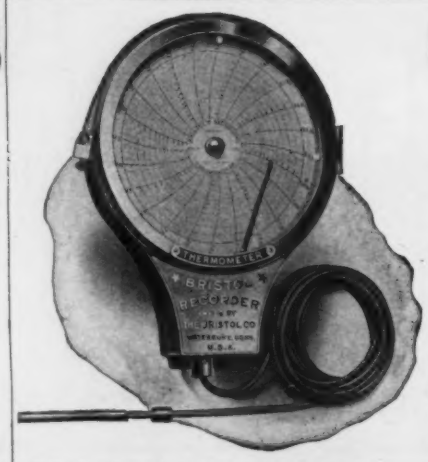

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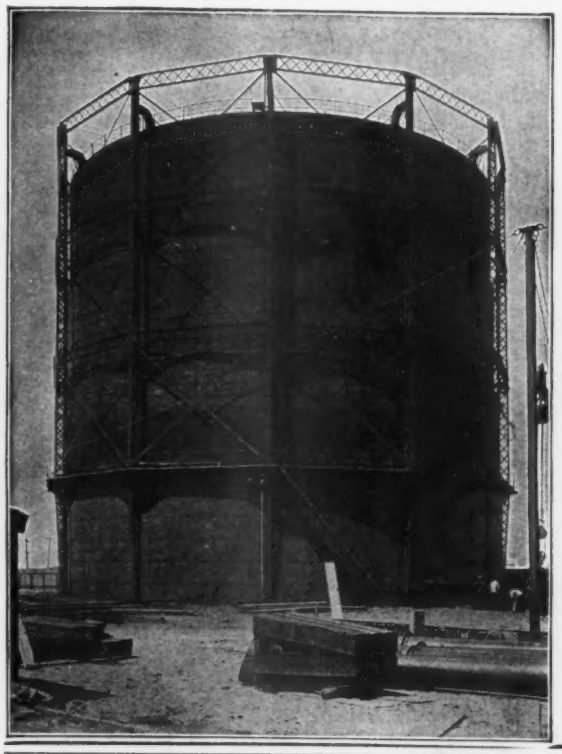

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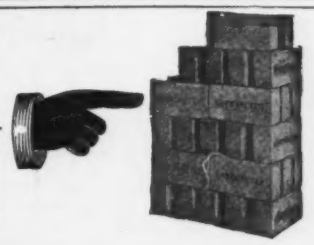

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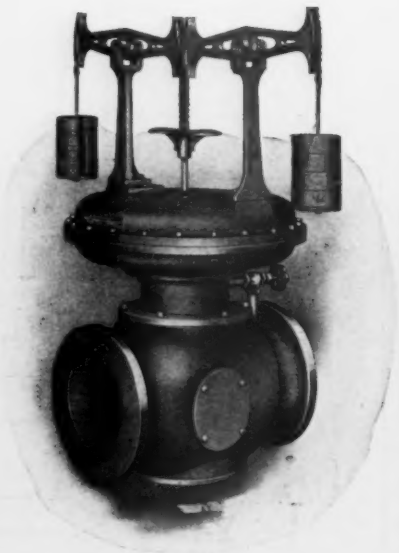

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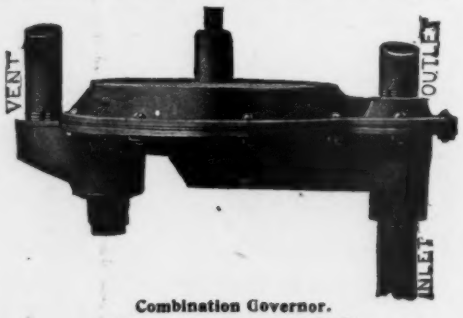

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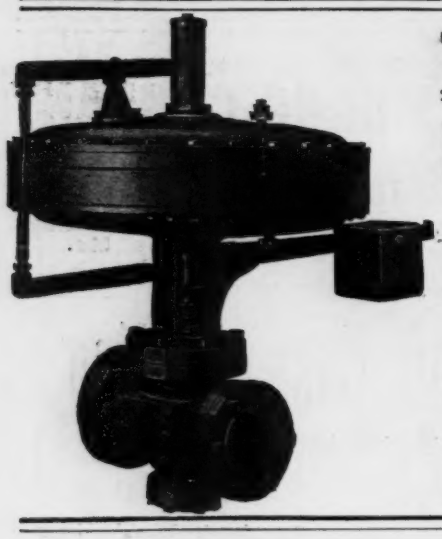

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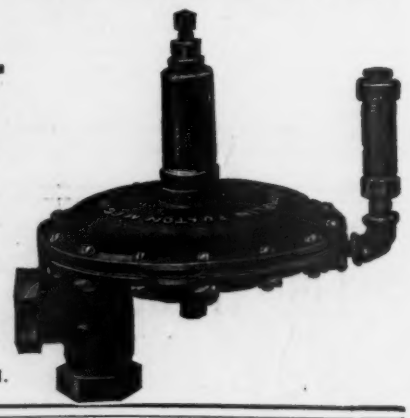

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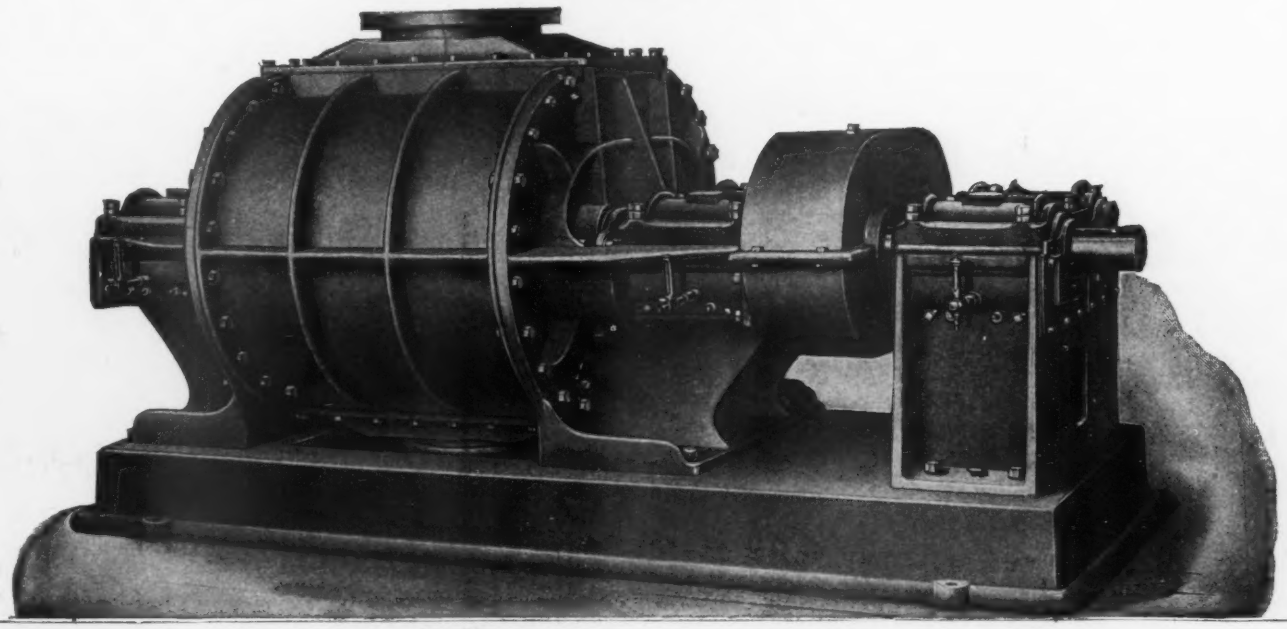

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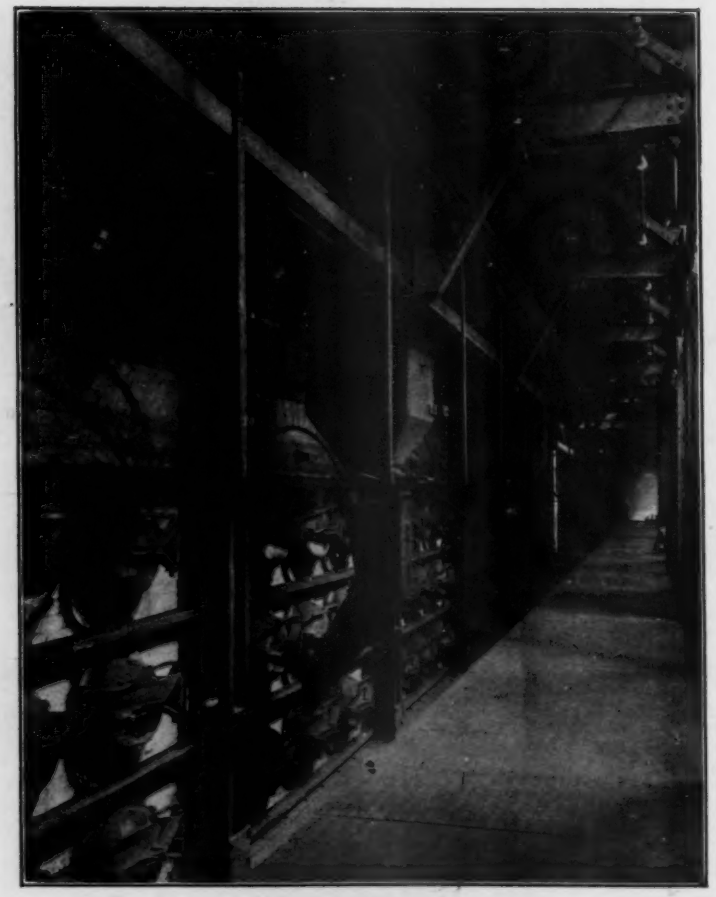

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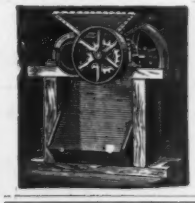

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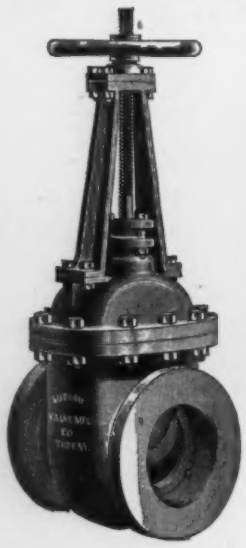

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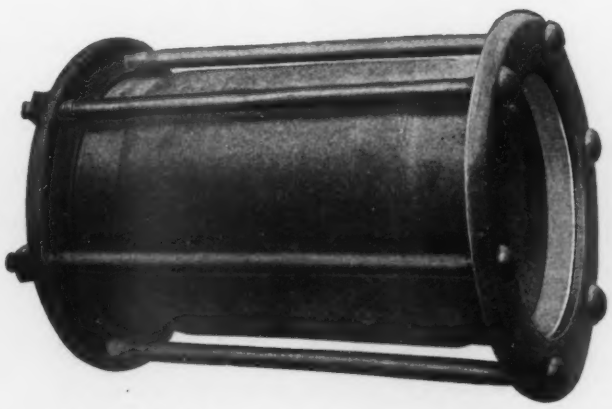

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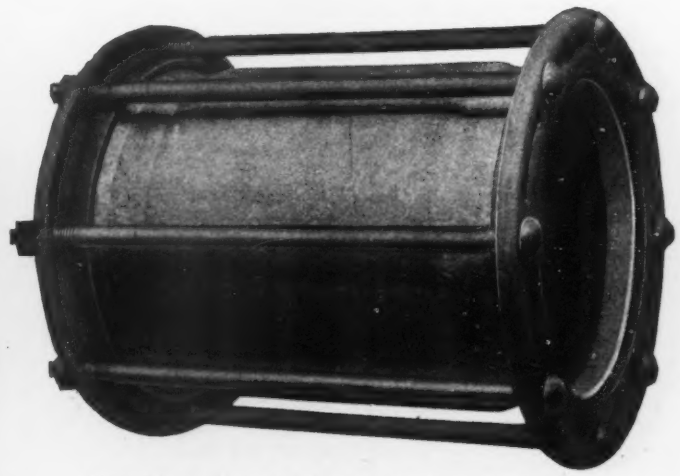

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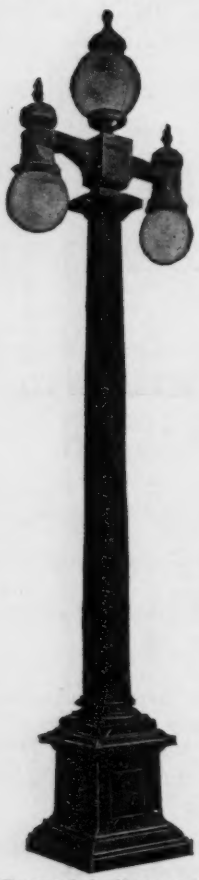

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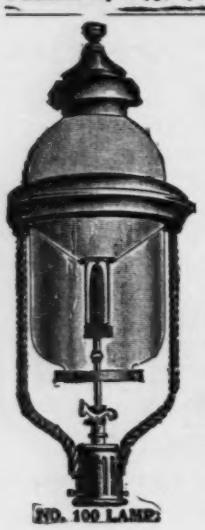

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PUBLIC LIGHTING TABLE FOR JANUARY, 1912

[Communicated by The American Meter Company.]

Day of Week.	MOONLIGHT SCHEDULE.		
	Date.	Light.	Extinguish.
Monday	1	4.20 A.M.	6.20 A.M.
Tuesday	2	No L.	No L.
Wednesday	3	No L. F.M.	No L.
Thursday	4	No L.	No L.
Friday	5	5.20 P.M.	7.10 P.M.
Saturday	6	5.20	8.30
Sunday	7	5.20	9.40
Monday	8	5.20	11.00
Tuesday	9	5.20	12.10 A.M.
Wednesday	10	5.20 L.Q.	1.10
Thursday	11	5.20	2.20
Friday	12	5.20	3.20
Saturday	13	5.20	4.30
Sunday	14	5.30	5.30
Monday	15	5.30	6.20
Tuesday	16	5.30	6.20
Wednesday	17	5.30	6.20
Thursday	18	5.30 N.M.	6.20
Friday	19	5.30	6.20
Saturday	20	5.30	6.20
Sunday	21	5.30	6.20
Monday	22	5.30	6.20
Tuesday	23	8.20 P.M.	6.20
Wednesday	24	9.20	6.20
Thursday	25	10.30	6.20
Friday	26	11.30 F.Q.	6.20
Saturday	27	12.40 A.M.	6.20
Sunday	28	2.00	6.10
Monday	29	3.10	6.10
Tuesday	30	4.20	6.10
Wednesday	31	5.30	6.10

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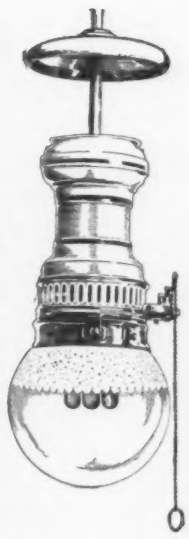

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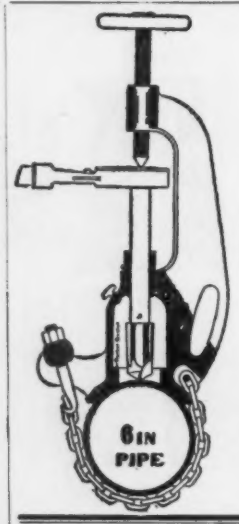

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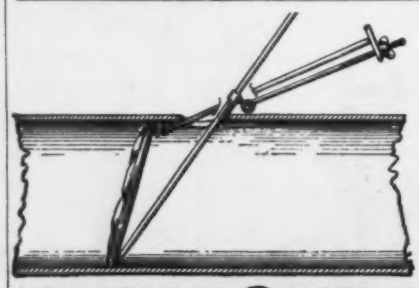

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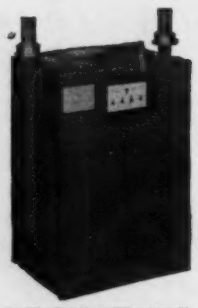

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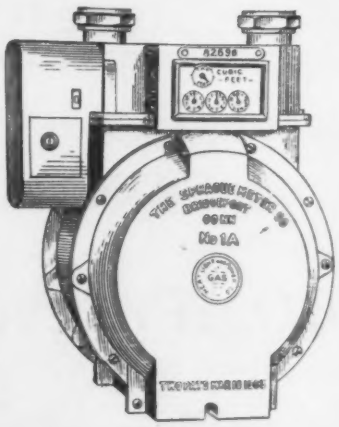

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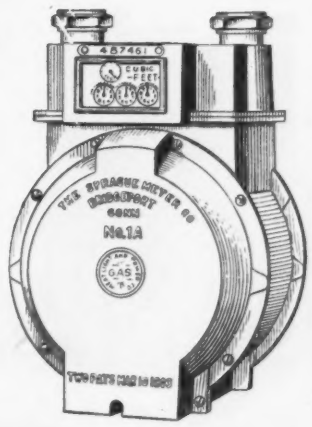

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METERS, Plain and Prepayment,

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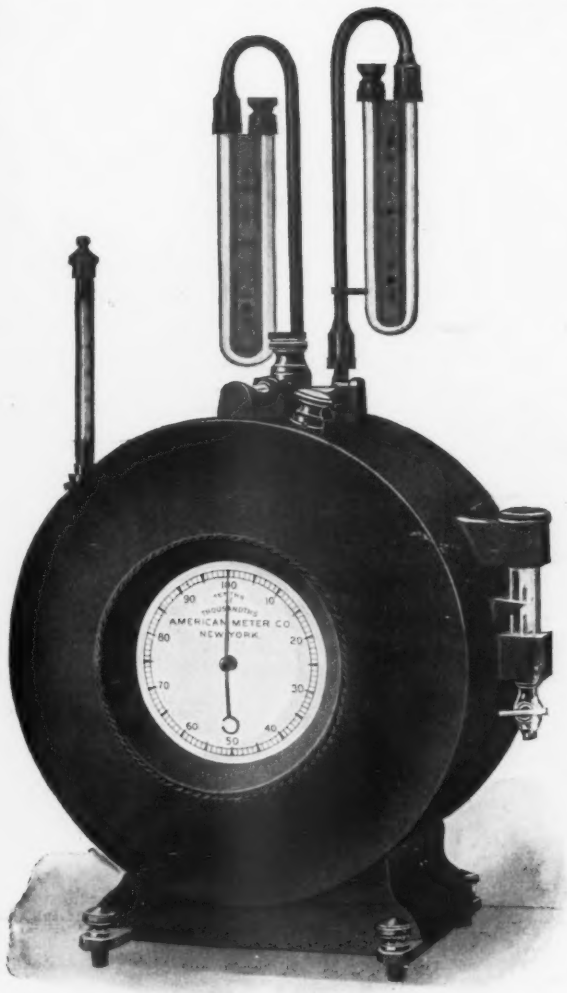

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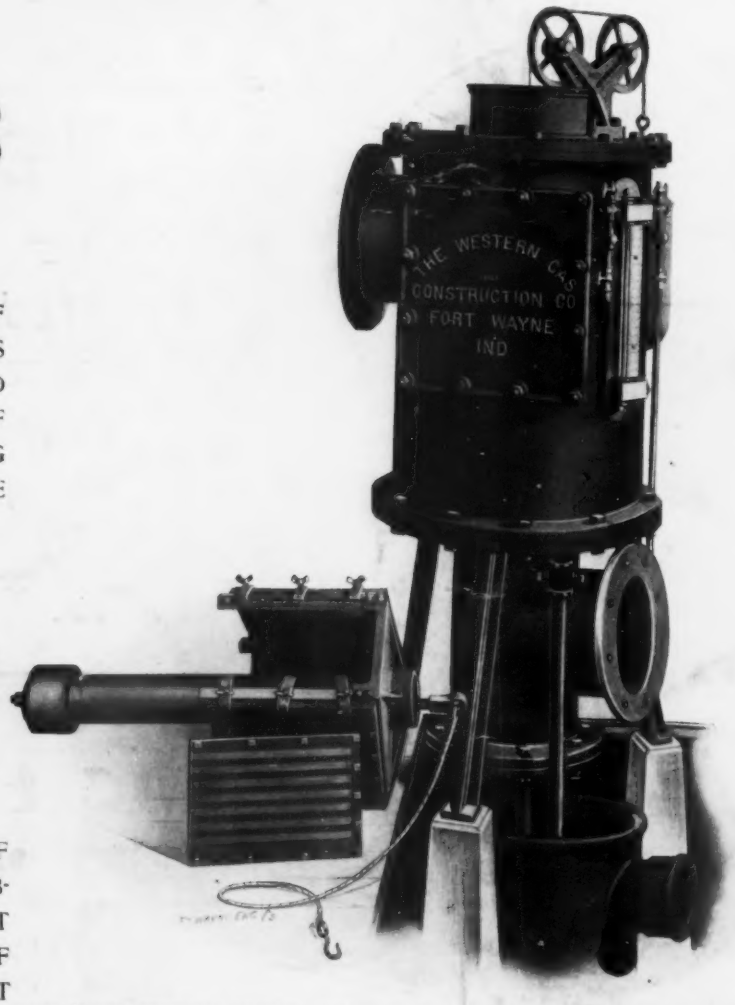

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